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A GENERIC REVISION OF THE PIERIDAE (LEPIDOPTERA)

Together with a Study of the Male Genitalia

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INTRODUCTORY AND HISTORICAL

The present paper is an attempt on the part of the author to bring the generic classification of the family Pieridae up to date. The taxonomy is based on a thorough study of the male genitalia in addition to previously used characters. The nomenclature is based on the rules of the International Code of Zoological Nomenclature.

Aside from various works dealing with limited faunas, there has been no publication by a single author dealing with the Pieridae as a whole, since the adoption of the present Code. The synonomy is therefore in need of revision.

The work of the early naturalists and entomologists can hardly be called revisional because of the limited amount of material studied by them. The first work that can thus be termed revisional was that of Doubleday ('46). Butler ('70) next published a thorough revision and classification of the genera, making considerable use of the wing venation. Kirby ('71 & '76) paid little attention to the recently erected genera of Butler and others, preferring to hold to the few large genera of previous authors. Scudder ('75) in a list of the generic names proposed for butterflies made no attempt to coordinate his data, following an alphabetical arrangement for the group as a whole. His data regarding the genotypes is invaluable, though not entirely reliable.

Schatz ('92) published a fairly complete classification of the genera, but included little of nomenclature or other systematic details. Grote ('00) published a theory of the phylogeny of the family based on the venation, and included a few nomenclatorial changes. Dixey ('94) proposed a theory of the phylogeny of the family based on an exhaustive study of the pattern and geographical distribution. Finally, in a collective work on the Macrolepidoptera of the world various authors (Roeber '06 & '10, Aurivillius '10 and Fruehstorfer '10) treated the family very completely but almost entirely for the purpose of the identification of species, paying little attention to generic taxonomy.

THE TAXONOMIC VALUE OF THE MALE GENITALIA

Up to comparatively recent times little work has been done on the male genitalia of the *Pieridae,* workers being apparently either ignorant or distrustful of the taxonomic importance of these structures. Indeed many workers today adhere to one or the other of these opinions. What work has been done has been quite spasmodic, and in many cases has been based merely on examination of the external appearance.

Godman and Salvin ('89) thus made considerable use of the genitalia for generic separation, but only for the limited fauna included in their work. Fruehstorfer ('08) figured the genitalia of a number of species and subspecies, mainly in a somewhat abortive attempt to prove that these structures might be used for subspecific separation. His conclusions seem to be largely invalidated by an apparent lack of uniformity in the preparation of his material and by failure to allow for individual variation. Talbot ('28, '29a, b & c, '30a) has made considerable use of the genitalia in his monograph of the genus *Delias*, showing that they can be used for the separation of the species into groups, and, in the majority of cases at least, present characters for specific determination. Brown ('29) found excellent and stable characters for specific differentiation in the genitalia of the genus *Phoebis*. The present author ('28a, b, '29b, c, & '30) has figured the male genitalia of a number of genera and pointed out their taxonomic value in these cases.

In the majority of families of the Lepidoptera the taxonomic importance of the male genitalia is unquestioned. In many groups these structures are far more reliable than any other characters. The *Pieridae*, however, seem to have a bad reputation in this respect. Criticism of the use of the genitalia in this family appears to be of two kinds, based either on a belief that individual variation is so great as to prevent the systematic use of the structures, or on a fear that in structures so much used by and so vital to the insects, development may have been so rapid and at random as to invalidate their use in phylogeny.

Fears regarding the importance of individual variation may be set at rest by examination of a sufficient number of specimens, and by a realization that too much must not be expected of the genitalia as specific characters. Individual variation may occur in some genera to such an extent that all of the species cannot be safely differentiated by the genitalia. Far more often, however, the opposite is true; the genitalia show so little variation, even between very distinct species, that they cannot be used. Neither of these cases, however, need necessarily have anything to do with the use of the genitalia for generic separation.

As an example of this *Nathalis* will serve excellently. The author has been unable to find any stable characters for differentiating *iole* and *plauta* by the genitalia. On the other hand the genitalia of these two species are so utterly different from those of

any other *Pieridae* that failure to consider them as an important generic character would be absurd. In fact the author has found only one or two cases in which identification of a specimen to any of the genera and subgenera held as valid in this paper may not be accomplished by the genitalia alone, except in the case of a few subgenera (of doubtful value) whose only character is the presence or absence of sex scaling.

The subject of individual variation cannot be left without discussion of a factor that has in all probability caused a very large part of the misapprehension on this subject. In the preparation of the genitalia for study or in the preservation of such material, distortions may be very easily produced without the worker being conscious of the fact. Great care and uniformity of technique is therefore necessary in this matter. The abdomens of papered specimens are often considerably flattened, so that unless this effect is overcome the apparent size and shape of most of the important structures may be radically altered. Generally, however, thorough soaking in water or in a weak potash solution will more or less restore the organs to their normal shapes. Flattening of this sort must, however, always be allowed for.

Similarly pressure in mounting the genitalia for study on a microscope slide causes a great deal of distortion. To overcome this the author is in the habit of studying and drawing his material while it is immersed in a watch-glass or deep well-slide, thus doing away with danger of flattening due to the pressure of the cover-glass. Mounting on slides is only used as a handy means of preservation. The study of dried specimens is not to be recommended, in view of the unnatural effect of drying normally moist structures.

Beliefs regarding the untrustworthiness of the male genitalia of the *Pieridae* due to individual variation are then probably based on the following:

a. Study of too few specimens.

b. A tendency to expect at first too much of the genitalia.

c. Careless, faulty or uneven technique, or the use of badly preserved specimens, resulting in distortion of the genitalia.

The author believes also that the genitalia are to a great degree to be relied upon in a study of the phylogeny of the *Pieridae*. Opinions to the contrary appear to be based either on an opinion that the genitalia may have developed so rapidly and at random that their modifications may not safely be considered phylogenetic, or on a fear of the possibility of convergent modification of the genitalia in the case of really different stocks.

It seems reasonable to believe that in the course of the evolution of a species or of a larger group superficial characters would show a faster rate of modification than would more fundamental ones. Moreover it is impossible to discount the part played in such development by the process of adaptation to the environment, however it may be believed that this adaptation is brought about. If, then, we analyze the structures which are most likely to be affected by such adaptation we find that included in the list are all of those characters which the opponents of the use of the genitalia use in their own systems of classification. Color, pattern and size are all obviously very mutable. Locomotor organs such as the wings and legs, and sensory organs such as the antennae and palpi, are the very structures in which we may expect to see effected almost every response to a fluctuating environment. On the other hand in the genitalia are found a set of structures whose variations can hardly be affected by changes in environment, and must originate in changes within the protoplasm of the species, unaffected by external conditions. Moreover changes in the genitalia must of necessity be more slowly effected. In other characters the sexes may develop almost independently of each other; in the genitalia a change in the structures of one sex can only survive if there are corresponding changes in the structures of the other. Even a considerable change in the wing form of one sex need have no effect upon the ability of the individuals affected to survive and reproduce. Knowing as we do of the minute adaptations of the structures of the female genitalia to those of the male, or vice versa, we can hardly doubt the necessity of a very close correlation of the development of the genitalia of one sex with those of the other.

The development of practically all of the external features, motor organs and sensory organs must be regarded as modifications to some degree controlled by the physical environment of the species. The development of the genitalia must be regarded as modifications nearly or entirely independent of such environment. Neither of these types of modifications can be ignored in phylogenetic work. Conclusions based on data obtained from a study of only one of these, ignoring or slighting the other, must necessarily be false and unbalanced.

The possibility of accidental convergence must always be taken into account. Here again, however, the effect of environment must be considered, and most strongly with respect to those structures which are most likely to be affected by environment. To cite an

example familiar to all, attention must be called to the very close similarity existing between various mammals of widely differing relationships which, specialized for burrowing in the ground, have attained a form typified by the Mole. Thus we find a Marsupial Mole extraordinarily like the Insectivore Mole, and most fundamentally distinguished from it by the structure of the reproductive system. It is surely not too far-fetched to say that just as in these mammals the bones of the fore limb have become modified to a high degree of convergence so in Pierids the veins of the wings may become modified. There seems far more possibility of such an occurrence than of a convergence of such comparatively independently developing structures as the genitalia.

It must also be remembered that mathematically the chances of convergence in color, type of pattern, wing shape, venation and vestiture are far greater than in the genitalia. Pattern in the *Pieridae* is after all merely the effect of a very few different combinations of light and dark shades. Wing shape is limited to a comparatively few possibilities. With regard to the venation there are more combinations available, but the total number is really small. In the *Pieridae* only a few veins show any amount of modification; those that do so vary only in a definite direction. Moreover all of these structures are strictly limited in their variation to one plane. In the male genitalia, however, are a considerable number of structures which may develop to a considerable degree independently of each other in three dimensions as well as in mere size. In the venation we find that a greater degree of fusion among R_3, R_4 and R_5 must necessarily be accompanied by a moving toward the costa of M_1, which in turn usually brings about a corresponding movement of M_2. In the genitalia, however, we see that the uncus may develop quite independently of the juxta (cf. *Aporia crataegi* and *Synchloë callidice*) or vice versa, the saccus of the harpé (cf. *Colotis evippe* and *Neophasia menapia*), and so on; that while of course a certain functional balance must be kept there is little evidence of any great degree of correlation in the development of the various structures. It is obvious that there is here infinitely less possibility of convergence, and that a close similarity of structure is far more likely to indicate a close relationship.

The author has therefore taken the genitalia very seriously into account in reaching his phylogenetic conclusions. Because of the high degree of convergence evident in the wing venation this

character has been little used qualitatively, that is to say in determining actual relationship, although quantitatively, for determining the amount of development that has occurred, it is useful.

Discussions of the main lines of development in the various structures will be found in the following section with the descriptions of the terms employed for the structures, and in the phylogenetic discussions of each genus.

DESCRIPTION AND NOMENCLATURE OF MORPHOLOGICAL TERMS

Wing Venation

The Comstock-Needham system of nomenclature for the veins has in general been followed throughout. The primitive butterfly fore wing is possessed of five branches of Radius, (R_1, R_2, R_3, R_4 and R_5), and three branches of Media (M_1 M_2 and M_3) all of which arise from the cell separately from each other. The cross vein between the bases of R_5 and M_1 is the upper discocellular (*udc*), that between the bases of M_1 and M_2 is the middle discocellular (*mdc*), and that between the bases of M_2 and M_3 is the lower discocellular (*ldc*). In the hind wing R_1 has fused with Subcosta (*Sc*) forming the vein $Sc + R_1$, and the remaining branches of Radius have fused together to form the Radial Sector (R_s).

In the most primitive of the *Pieridae* we find that all five radials are present, with the branches of Media all arising from the cell (*Eroessa, Dismorphia*). The progress of development appears to have been along the lines of a fusion together of certain of the branches of Radius, or of a loss of one of these branches (R_2), or both. In any case the result is a reduction in the number of radials. This is accompanied by a moving toward the costa and apex of the branches of Media. The fusion of the radials is accomplished by a progressive coalescence of their bases from the discal cell toward the apex. R_4 and R_5 are the first to fuse (figs. 3 & 2), followed by the fusion of R_3 with R_{4+5} (figs. 6, 4, 5, 7). As stated R_2 may drop out (*Delias*), leaving only one radial arising from the cell, or it may show a tendency to coalesce with the other radials by progressive fusion toward the apex (fig. 7). R_1 never drops out, but may like R_2 tend to fuse with the other radials (fig. 2). Correlated with the reduction of the radials, M_1 moves toward the upper end of the cell and from there fuses progressively with the radials toward the apex (figs. 3, 6, 4, 5, 7). In the *Pierinae*

M_2 follows after M_1 with a corresponding shortening of the middle discocellular, but in the *Dismorphiinae* M_2 appears to remain in its more primitive position. In *Pseudopontia* R_3, R_4 and R_5 have all fused, and M_1 and M_2 have moved far toward the costa and apex and are well stalked on R_{3+4+5}. In the fore wing *Pseudopontia* is therefore definitely Pierine rather than Dismorphiine.

Comparatively few developments take place in the hind wing. The most noticeable is the occasional stalking of R_s and M_1, usually accompanied by a moving forward of the base of M_2.

We may therefore consider the possession of five radials as a primitive character, and the lessening in number of the radials as more highly developed. The separation of M_1 from the upper angle of the cell is primitive, and the progressive approach of the base of M_1 to the upper angle of the cell and its stalking on the Radial stem is highly developed. In the *Pierinae* and *Pseudopontiinae* the same holds true for M_2.

Leg and Foot (fig. 8)

The basal joint of the tarsus, longer than the others, is referred to as the *metatarsus.* In some cases the length of this joint compared with the length of the tibia appears to constitute a reliable taxonomic character.

The *paronychia* are slender membranous structures lying basad and to the outside of the tarsal claws. They are present in all of the genera of the family except *Nathalis, Colias, Baltia* and *Phulia.*

The *pulvillus* is a single median structure lying between the tarsal claws. It is present in all the genera of the Pierinae except *Gonepteryx, Colias, Nathalis, Baltia* and *Phulia.*

Male Genitalia

In previous papers the author has discussed the structures of the male genitalia more exhaustively than seems warranted here (see Klots '28a, '28b, '29b, '29c, '30). However it seems advisable to give here a short outline of the terms applied to the various structures, for the benefit of those who may not have these or other works available.

The male genitalia are composed of various structures lying within the distal portion of the abdomen and of others articulating to the distal margin of the eighth abdominal segment. The *vinculum* is a flattened ring, with which is connected the intersegmental membrane from the eighth abdominal segment. Ven-

trally the vinculum connects with the *saccus,* a tubular structure of varying size which extends cephalad inside the abdomen and must function as a brace. Dorsally the distal margin of the vinculum articulates with the *tegumen,* which is thin and more or less hemispherically bent. The *uncus* articulates to the distal margin of the tegumen. On the ventral (lateral) margins of the tegumen are found a pair of processes to which the dorsal-basal angles of the harpés articulate. These processes are here termed the *articulatory processes of the tegumen.* They may be homologous with the gnathos or in part with the transtilla of other lepidoptera.

The *rectum* runs caudad within the curve of the tegumen, ending with the *anus* which is connected to the ventral portion of the uncus. From below the anus a median fold of membrane runs ventrad and joins the *juxta.* Chitinization in the region of the anus, usually below it, is termed the *subscaphium.*

The paired *harpés* articulate dorsally with the articulatory processes of the tegumen, and ventrally along the median line with each other and basally with the vinculum. Each harpé is composed of an outer and an inner layer. The outer layer is usually evenly and well chitinized, with a thickened base for strengthening the articulations. From this base a thin membrane runs cephalad and joins the vinculum.

The inner layer of the harpé is thin and membranous in the central area, and more or less thickened, chitinized and setiferous at the margins. Pierce ('09) has termed the dorsal thickening of the harpé the *margin* and the ventral thickening the *sacculus.* The distal end of the harpé may bear a more or less elongated structure, the *distal process.* Various lobes or spines may arise from the margin or the sacculus. Only in *Nathalis* and *Kricogonia* are structures found attached to the outer face of the harpé.

In what the author considers the interrelated stock of genera from *Aporia* to *Delias* and *Leodonta* a spinulated membranous sac is found lying between the two layers of the harpé. Coincident with this structure, which is here termed the *inner sac* (figs. 65, 68) is a peculiar sort of a *fovea* in the central region of the harpé, often more or less covered by a chitinized flap. This fovea and flap appear to be present also in *Belenois* and *Prioneris.*

The *clasper* is a thin, usually heavily chitinized structure, present in only a few genera, which articulates basally to the basal portion of the inner face of the harpé, its free part lying parallel to the plane of the harpé. It is of very constant occurrence in more primitive Lepidoptera.

The sacculi are more or less fused together along the median line, and along this line of fusion usually articulate with the *juxta*. From cephalic or caudal aspect this latter structure is triangular or shield-shaped. It is thin, and usually rather heavily chitinized, although dorsally, where it connects with the median fold of membrane from the anus, it may be lightly chitinized. The juxta is sometimes flat, but is usually more or less hollowed out or "dished," the convex surface being toward the caudal end. In the Rhodocerini the juxta assumes the form of a long, thin bar; it lies caudad between the articulations of the sacculi, then bends abruptly cephalad and extends beyond the vinculum. At its extremity it is usually forked and supports a rounded, cephalad extension of the median fold of membrane, which in turn supports the penis. At the two points where the ends of the forked juxta meet with this membrane may be chitinized areas for their attachment, and the ends of the forks themselves may be somewhat expanded for attachment to these chitinized areas.

The term *penis* is here used for the heavily chitinized tube, inside of which is the more membranous tube of the *ejaculatory duct*, and outside of the basal part of which is a membranous tube which ends caudally in the median fold of membrane below the anus, or in the inner membranous folds running cephalad from the inner face of the harpé. The penis is sometimes armed with heavily chitinized spines or teeth, to which the term *cornuti* has been incorrectly applied by some authors. The true cornuti, in the sense as the term was first used by Pierce, are the chitinized spines on the eversible tip of the ejaculatory duct (figs. 1, 14, 16, 17, 18).

Attached ventrally to the basal part of the penis and usually running more or less caudad, is a sometimes heavily chitinized spur, which serves as a muscle attachment, and may contain a muscle for working the ejaculatory duct. This is here termed the *basal prong of the penis*. It is entirely absent in adult life in some genera. It appears to arise quite early in embryonic life. (Zander '03).

In the *Pseudopontiinae* and *Dismorphiinae* many changes have taken place from the types of structures described above for the *Pierinae* (figs. 11–18). In general so much fusion of various structures has occurred that the homologies of some of the parts are obscure. The tegumen appears to have become much reduced. The uncus has taken the form of a pair of lobes on either side of the anus. The harpés have become firmly fused together along

the ventral margins for the greater part. Their dorsal portions are strongly connected by a heavily chitinized transverse structure which may represent the juxta and is at least analogous to the transtilla. Immediately above this is a tubular sheath for the distal portion of the penis.

There is great need for some careful work on the pupal development of the Dismorphiine genitalia, similar to that of Zander ('03) and others, to determine the homologies of these organs, if such is possible. *Leptidia sinapis* L. should be an excellent subject.

As previously stated most of the developments of the various structures of the genitalia seem to have occurred quite independently of each other. This makes definite delineation of the lines of development rather difficult. The presence of a clasper may fairly safely be considered primitive. Those genera which show this character have been placed together in the *Euchloini,* although this may not be a truly natural grouping, as the structure may have been retained independently. *Teracolus subfasciatus* possesses a rudiment of a clasper only, and must therefore be considered as in this respect the most primitive of the *Colotis* group of subgenera and genera. *Mylothris* has a structure on the inner face of the harpé which resembles the clasper, but which the author does not consider truly homologous.

The most primitive forms appear to have had a comparatively simple harpé, with few structures. After the loss of the clasper various lobes, spines and processes may develop on the harpé. In the *Pierini* such developments occur quite spasmodically, and seem to have no great intergeneric phylogenetic significance. In the *Rhodocerini* the development of such structures is quite the rule, practically all of the genera showing something of the sort.

The tegumen remains comparatively constant throughout the *Pierini* and *Euchloini.* In the *Rhodocerini* it becomes reduced by shortening until in some of the genera it is little if any longer than the vinculum, and considerably shorter than the uncus. The articulatory process of the tegumen shows considerable variation in the *Pierini,* being very large in some genera (*i.e., Belenois*) and very small in others (*i.e., Catasticta*). These developments appear to be quite independent of the size of the tegumen itself. In the *Rhodocerini* the articulatory process of the tegumen varies less in size, but is nearly always of a characteristic slender, pointed shape.

Variation in the uncus is quite marked. Often the tip becomes bifurcate (*Terias* and *Hebomoia*). The free part of the uncus,

i.e. the part distad of the attachment of the anal membrane, may be extremely short (*Terias, Pyrisitia*) or many be very long and slender (*Itaballia*). The uncus may be long and slender (*Itaballia*) or very much thickened dorso-ventrally (*Aporia, Leptophobia*).

The juxta is normally a flat or slightly curved transverse plate, triangular or shield-shaped. Dorsally it is nearly always concave or notched where it serves as a support for the penis. In a number of the genera it becomes deeply ballooned out caudad (*Tatochila*). This process may affect the entire structure or may be confined to the central portion (*Pieris, Itaballia*) with the resulting formation of a long thin tube. In the *Rhodocerini* the juxta is in the form of a narrow bar extending cephalad and supporting a paired cephalad fold of the median membrane which in turn supports and surrounds the penis. This produces a structure very similar to some modifications of the *anellus* (Pierce '14 p. xxvi).

The penis shows a great deal of variation as regards length (cf. *Leptophobia* and *Moschoneura*), shape (cf. *Colias, Dercas* and *Dixeia*), presence or absence of the basal prong, and armament. The most striking example of the latter is found in *Catopsilia thauruma* (see Klots '29b, fig. 10b).

Comparatively few of the genera show any development of a subscaphium. Such as there is is slight, being limited to a small amount of chitinization in the anus. *Pereute* shows the greatest development in this respect.

There is thus no lack of characters for both taxonomic and phylogenetic use, although the genitalia of the family show far less differentiation than in practically any of the other families of the *Lepidoptera*. The male genitalia must be used as characters with great care, and only after the examination of sufficient series of specimens, but when so used they present facts which the careful worker cannot afford to slight or ignore.

SYNONYMIC CHECKLIST OF GENERA, WITH TYPE SPECIES

Family PIERIDAE

Subfamily Pseudopontiinae

1. Pseudopontia Ploetz, *paradoxa* Felder
   = *Globiceps* Felder, *paradoxa* Felder HOMONYM
   = *Gonophlebia* Felder, *paradoxa* Felder

Subfamily Dismorphiinae

2. Leptidia Dalman, *sinapis* L.
   = *Leucophasia* Stephens, *sinapis* L.
   = *Leptoria* Stephens, *sinapis* L.
   > *Azalais* Grote, *gigantea* Leach
3. Pseudopieris Godman & Salvin, *nehemia* Boisduval
4. Dismorphia Huebner, *laia* Huebner
   > *Leptalis* Dalman, *astynome* Dalman
   > *Hemerocharis* Boisduval, MS synonym of *Leptalis*
   Subg. ACMEPTERON Godman & Salvin, *nemesis* Latreille
   Subg. ENANTIA Huebner, *licinia* Huebner
   > *Licinia* Swainson, *melite* L. HOMONYM
   > *Enantia* Godman & Salvin, *melite* L.
   Subg. MOSCHONEURA Butler, *methymna* Godart
   Subg. nov. **PATIA**, *orise* Boisduval

Subfamily Pierinae

Tribe Euchloini

5. Eroessa Doubleday, *chilensis* Blanchard
6. Anthocharis Boisduval, *cardamines* L. (See discussion of synonymy)
   = *Mancipium* Stephens, *cardamines* L. HOMONYM
   > *Tetracharis* Grote, *cethura* Felder
   Subg. FALCAPICA Klots, *genutia* Fabricius
   = *Midea* Herrich-Schaeffer, *genutia* Fabr. HOMONYM
7. Zegris Rambur, *eupheme* Esper
   Subg. MICROZEGRIS Alphéraky, *pyrothoë* Eversmann
   = *Pyrothoia* Verity, *pyrothoë* Eversmann
8. Euchloë Huebner, *belia* Cramer
   Subg. ELPHINSTONIA Klots, *charlonia* Donzel
   > *Phyllocharis* Schatz, *tagis* Huebner, HOMONYM
9. Hesperocharis Felder, *erota* Lucas
   > *Heliochroma* Butler, *idiotica* Butler
   Subg. CUNIZZA Grote, *hirlanda* Stoll
   > *Cathaemia* auct. nec Huebner
   Subg. MATHANIA Oberthür, *esther* Oberthür
10. Pinacopteryx Wallengren, *eriphia* Godart
    = *Herpaenia* Butler, *eriphia* Godart
    = *Picanopteryx* Scudder, *eriphia* Godart
11. Hebomoia Huebner, *glaucippe* L.
    = *Iphias* Boisduval, *glaucippe* L.

Tribe Rhodocerini

12. Colias Fabricius, *hyale* L. (See discussion of synonymy)
    = *Eurymus* Swainson, *hyale* L. HOMONYM
    > *Eriocolias* Watson, *edusa* Fabricius
    > *Scalidoneura* Butler, *herminia* Butler
    Subg. ZERENE Huebner, *caesonia* Stoll
    = *Meganostoma* Reakirt, *caesonia* Stoll
    = *Megonostoma* auct.
13. Catopsilia Huebner, *crocale* L.
    > *Murtia* Huebner, *pyranthe* L.
14. Anteos Huebner, *maerula* Fabricius
    = *Amynthia* Swainson, *maerula* Fabricius
    Subg. RHODOCERA Boisduval & Leconte, *menippe* Huebner
15. Gonepteryx Leach, *rhamni* L. (See discussion of synonymy)
    = *Gonoptera* Dalman, *rhamni* L.
    = *Earina* Speyer, *rhamni* L.
    = *Goniapteryx* Westwood, *rhamni* L.
    = *Gonioptera* Wallengren, *rhamni* L.
16. Dercas Boisduval, *verhuelli* Hoeven
17. Phoebis Huebner, *argante* Fabricius
    = *Prestonia* Schaus, *clarki* Schaus (= ♀ *argante*)
    > *Callidryas* Boisduval & Leconte, *eubule* L.
    > *Metura* Butler, *cipris* Fabricius, HOMONYM
    > *Parura* Kirby, *cipris* Fabricius
    Subg. RHABDODRYAS Godman & Salvin, *trite* L.
    Subg. APHRISSA Butler, *statira* Cramer
18. Kricogonia Reakirt, *lyside* Godart
19. Leucidia Boisduval, *elvina* Godart
20. Gandaca Moore, *harina* Horsfield
21. Eurema Huebner, *daira* Godart
    > *Sphaenogona* Butler, *ectriva* Butler
    Subg. ABAEIS Huebner, *nicippe* Cramer
    = *Xanthidia* Boisduval & Leconte, *nicippe* Cramer
    Subg. PYRISITIA Butler, *proterpia* Fabr.
    Subg. TERIOCOLIAS Roeber, *atinas* Hewitson
    Subg. MAIVA Smith & Kirby, *brigitta* Cramer
    > ?*Kibreeta* Moore, *libythea* Fabricius
    Subg. NIRMULA Moore, *venata* Moore
    Subg. TERIAS Swainson, *hecabe* L.
    > *Heurema* Herrich-Schaeffer, *impura* Vollenhoven
22. Nathalis Boisduval, *iole* Boisduval

Tribe Pierini

23. Eronia Huebner, *cleodora* Huebner
    > *Dryas* Boisduval, *leda* Boisduval

24. Nepheronia Butler, *argia* Fabricius
    > *Leuceronia* Aurivillius, *buqueti* Boisduval
25. Pareronia Bingham, *valeria* Fabricius
    > *Paphia* Fabricius *in part*
26. Colotis Huebner, *amata* Fabr.
    > *Aphrodite* Huebner, *evippe* L.
    > *Idmais* Boisduval, *chrysonome* Klug
    > *Callosune* Doubleday, *danaë* Doubleday & Hewitson
    > *Anthopsyche* Wallengren, *achine* Cramer
    Subg. TERACOLUS Swainson, *subfasciatus* Swainson
    = *Ptychopteryx* Wallengren, *subfasciatus* Swainson
    = *Thespia* Wallengren, *subfasciatus* Swainson
    Subg. CALOPIERIS Aurivillius, *eulimene* Klug
    Subg. MADAIS Moore, *faustus* Olivet
27. **GIDEONA,** genus nov. *lucasi* Grandidier
28. Ixias Huebner, *pyrene* L.
    = *Thestias* Boisduval, *pyrene* L.
29. Eucheira Westwood, *socialis* Westwood
    = *Schatzia* Kirby, *socialis* Westwood
30. Neophasia Behr, *menapia* Felder
31. Catasticta Butler, *nimbice* Boisduval
32. Archonias Huebner, *tereas* Huebner
    = *Euterpe* Swainson, *tereas* Huebner
    > *Priamides* Huebner *in part*
    Subg. CHARONIAS Roeber, *eurytele* Hewitson
33. Aporia Huebner, *crataegi* L.
    = *Leuconea* Donzel, *crataegi* L.
    = *Futuronerva* Bryk, *crataegi* L. (a teratological aberration)
    Subg. MESAPIA Gray, *peloria* Hewitson
    Subg. METAPORIA Butler, *agathon* Gray
    = *Betaporia* Matsumura, *agathon moltrechti* Oberthür
34. Cepora Dalman, *nerissa* Fabricius
    > *Huphina* Moore, *coronis* Cramer
35. Delias Huebner, *egialea* Cramer
    > *Symmachlos* Huebner, *nigrina* Fabricius
    > *Thyca* Wallengren, *aganippe* Donovan
    Subg. CATHAEMIA Huebner, *caenaeus* L.
    > *Piccarda* Grote, *eucharis* Drury
36. Pereute Herrich-Schaeffer, *callinice* Felder
37. Leodonta Butler, *dysoni* Doubleday
38. Belenois Huebner, *calypso* Drury
    Subg. ANAPHAEIS Huebner, *creona* Cramer
39. Dixeia Talbot, *charina* Boisd.

40. Prioneris Wallace, *thestylis* Doubleday
41. Appias Huebner, *zelmira* Cramer
    Subg. CATOPHAGA Huebner, *melania* Fabricius
    > *Hiposcritia* Geyer, *pandione* Geyer
    > *Trigonia* Geyer, *nero* Fabricius
    > *Tachyris* Wallace, *nero* Fabricius
    > ?*Lade* de Niceville, *lalassis* Grose-Smith
    Subg. GLUTOPHRISSA Butler, *ilaire* Godart
    Subg. PHRISSURA Butler, *aegis* Felder
42. Udaiana Distant, *cynis* Hewitson
43. Saletara Distant, *panda distanti* Butler
44. Pieris Schrank, *brassicae* L.
    = *Ganoris* Dalman, *brassicae* L.
    Subg. nov. **GLENNIA**, *pylotis* Godart
    Subg. SYNCHLOE Huebner, *callidice* Esper
    = *Parapieris* de Niceville, *callidice* Esper
    Subg. PONTIA Fabricius, *daplidice* L.
    = *Leucochloë* Roeber, *daplidice* L.
45. Leptophobia Butler, *eleone* Hewitson
46. Leuciacria Rothschild & Jordan, *acuta* Rothschild & Jordan
47. Elodina Felder, *egnatia* Godart
    > ?*Parelodina* Fruehstorfer, *anticyra* Fruehstorfer, HOMONYM
    > ?*Elodinesthes* Fruehstorfer, *anticyra* Fruehstorfer
    > ?*Metelodina* Seitz, *anticyra* Fruehstorfer
48. Tatochila Butler, *autodice* Huebner.
    = *Tatocheila* Scudder, *autodice* Huebner
49. Baltia Moore, *shawi* Bates
50. Piercolias Grote, *huanaco* Staudinger
    = *Trifurcula* Staudinger, *huanaco* Staudinger, HOMONYM
    = *Andina* Roeber, *huanaco* Staudinger
51. Phulia Herrich-Schaeffer, *nymphula* Blanchard
52. Leptosia Hueber, *xiphia* Fabricius
    = *Nina* Horsfield, *xiphia* Fabricius
    > *Nychitona* Butler, *alcesta* Cramer
53. Itaballia Kaye, *pandosia* Hewitson
    Subg. nov. **PIERIBALLIA**, *mandela* Felder
54. Perrhybris Huebner, *pyrrha* Fabricius
55. Aoa de Niceville, *affinis* Vollenhoven
    = *Ava* auct.
56. Ascia Scopoli, *monuste* L.
    = *Mancipium* Huebner, *monuste* L.
    Subg. GANYRA Dalman, *amaryllis* Fabricius

57. Melete Swainson, *lycimnia* Cramer
    = *Daptonoura* Butler, *lycimnia* Cramer
58. Mylothris Huebner, *poppea* Cramer
    Subg. ? PSEUDOMYLOTHRIS Neustetter, *leonora* Kruger

KEYS TO SUBFAMILIES, TRIBES AND GENERA

The keys to subfamilies and tribes have been made "natural" as nearly as possible, in order to express the author's opinions regarding the phylogeny of the groups. The key to genera is more "artificial," making frequent use of superficial characters to facilitate its use. Phylogenetic discussions of the genera and keys to subgenera will be found in the succeeding section.

Key to Subfamilies

1. Tegumen very much reduced; uncus in the form of two lobes above or on either side of the anus; harpés fused together ventrad 2

   Tegumen not greatly reduced; uncus simple, at most furcate only at extreme tip, and always above anus; harpés never fused together for any great distance ..... Pierinae

2. All five radials present, stalked; M_2 of primary from cell with *mdc* long; $Sc + R_1$ of secondary separate from R_s; M_2 of secondary from cell with long *mdc;* antennal club distinct with prominent sense-pits; a heavily chitinized structure extending transversely between harpés just below penis. Dismorphiinae

   Only three radials present, R_1 and R_2 arising from cell; M_2 of primaries stalked on R_{3+4+5}; $Sc + R_1$ of secondary fused for a short distance at about $\frac{1}{3}$ with R_s; M_2 of secondary stalked with M_1; antennal club very slight; no heavily chitinized structure connecting harpés just below penis ..... Pseudopontiinae

DISMORPHIINAE

Key to Genera

1. Last abdominal segment deeply cleft 2
   Last abdominal segment not deeply cleft 3

2. Lobes of last abdominal segment rounded; M_1 of primary stalked on R-stem ..... *Pseudopieris*
   Lobes of last abdominal segment long and pointed; M_1 of primary from cell ..... *Dismorphia* (*Enantia*)

3. Tip of harpé with two heavily chitinized points; discal cell very short; *mdc* less than twice as long as *ldc;* Old World ..... *Leptidia*
   Tip of harpé with only one heavily chitinized point; discal cell long; *mdc* more than twice as long as *ldc;* New World *Dismorphia* (other subgenera)

PIERINAE

Key to Tribes

1. Clasper present, well developed, with its distal end free. Euchloini
   Clasper minute or absent or if present (*Mylothris?*) with its distal end not free 2
2. Third joint of palpus very short; antennal club gradual; raised line present; humeral vein usually greatly reduced or absent; color usually yellow or orange; tegumen short, usually considerably shorter than uncus; juxta usually bar-like and expanded at tip ..... Rhodocerini
   Third joint of palpus longer; antennal club usually more abrupt; raised line absent; humeral vein usually long; color usually white; tegumen longer than uncus; juxta a thin, transversely flattened plate ..... Pierini

EUCHLOINI

Key to Genera

1. Five radials present 2
   Four radials present 5

2. Base of uncus with paired, dorsal prominences; clasper with a strong dorsal point; tip of harpé with a patch of spines; M_1 of primary arising from cell; humeral bent slightly basad ..... *Eroessa*
   No paired, dorsal prominences at base of uncus; clasper rounded; tip of harpé unarmed; M_1 of primary stalked on R-stem; humeral straight 3

3. Dorsal margin of harpé with a triangular flap or tooth; R_2 from cell connate with or stalked on R-stem 4
   Dorsal margin of harpé unarmed; R_2 normally from cell somewhat below R-stem ..... *Anthocharis* (*Anthocharis*)
4. Apex of primary of male with an orange patch; saccus never twice as long as thick; penis lightly bent near base. *Zegris* (*Zegris*)
   Apex of primary of male without an orange patch; saccus at least twice as long as thick; penis strongly bent near base ..... *Euchloë*

5. One radial from cell ..... *Hesperocharis*
   Two radials from cell 6
6. M_1 from cell; size very large ..... *Hebomoia*
   M_1 stalked on R-stem; size medium or small 7
7. R_2 arising from cell nearer to base of R_1 than to end of cell; wings above with heavy dark markings ..... *Pinacopteryx*
   R_2 arising from nearer end of cell than to base of R_1; wings above white with dark markings, if any, light and limited to apical part of primary 8
8. Dorsal margin of harpé unarmed; R_2 normally from cell somewhat before end ..... *Anthocharis* (*Falcapica*) some species
   Dorsal margin of harpé with a triangular flap or tooth; R_2 normally from cell connate with or stalked on R-stem. *Zegris* (*Microzegris*)

RHODOCERINI

Key to Genera

1. Primary with 3 radials; pupa without frontal prominence. *Nathalis*
   Primary with 4 radials; pupa with frontal prominence 2
2. Tarsus with both pulvillus and paronychia; primary with R_2 from cell 3
   Tarsus with pulvillus but without paronychia; primary with R_2 from cell ..... *Leucidia*
   Tarsus without pulvillus but with paronychia; primary with R_2 from cell; secondary with a sharp tail on Cu_1. *Gonepteryx*
   Tarsus without either pulvillus or paronychia; R_2 often stalked on $R_3 + R_{4+5}$ ..... *Colias*
3. Wing expanse not over 55 mm. 4
   Wing expanse over 60 mm. 6
4. *udc* of secondary longer than *mdc;* outer margin of secondary rounded 5
   udc of secondary shorter than *mdc*, or secondary angulate or with a sharp tail between M_3 and Cu_1 ..... *Eurema*
5. Apex of primary rather sharp; outer margin straight; *udc* of secondary more than twice the length of *mdc;* New World ..... *Kricogonia*
   Apex of primary rounded; outer margin convex; *udc* of secondary little longer than *mdc;* Old World ..... *Gandaca*
6. Secondary with a sharp tail on M_3, or M_1 of primary stalked more than half way from end of cell to fork of $R_3 + R_{4+5}$ 7
   Secondary without a sharp tail on M_3 8
7. Secondary of male with a sex-patch; New World ..... *Anteos*
   Secondary of male without sex-patch; Old World ..... *Dercas*

8. Pupa with greatly expanded wing-cases; R_2 arising from well distad of end of cell; New World ..... *Phoebis*
   Pupa without greatly expanded wing-cases; R_2 arising from very near end of cell; Old World ..... *Catopsilia*

PIERINI

Key to Genera

1. Primary with 3 radials 2
   Primary with 4 radials 12a
   Primary with 5 radials 10
2. 2 radials arising from cell 3
   1 radial arising from cell 7
3. M_1 stalked more than half way from cell to apex; tarsus without pulvillus and paronychia ..... *Phulia*
   M_1 stalked less than half way from end of cell to apex; tarsus with both pulvillus and paronychia 4
4. M_2 connate with or short stalked on $R_3 + R_{4+5}$ ..... *Leptosia*
   M_2 from cell separate from $R_3 + R_{4+5}$ 5
5. *mdc* of secondary more than half as long as *ldc; ldc* of secondary almost straight ..... *Mylothris*
   mdc of secondary less than half as long as *ldc; ldc* of secondary angled 6
6. *udc* of secondary longer than *mdc:* humeral not bent sharply distad from very near its base ..... *Pieris* (*Pontia*)
   udc of secondary about equal to *mdc;* humeral bent sharply distad from very near its base ..... *Perrhybris*
7. Two radials arising basad of the base of M_1 of primary; *mdc* of primary very short ..... *Elodina*
   Only one radial arising basad of base of M_1; *mdc* of primary long 8
8. Tip of R_1 running along costal and apical margin, fusing with tip of R_3 ..... *Pereute*
   Tip of R_1 ending well basad of tip of R_3 9
9. Secondaries with a short tail on Cu_1 and a shorter one on Cu_2; New World ..... *Leodonta*
   Secondaries with outer margin rounded, without tails; Old World ..... *Delias*
10. *mdc* of primary less than half as long as *ldc;* harpé rounded, with no distal process; penis with basal prong ..... *Eronia*
    mdc of primary half or more as long as *ldc;* harpé with a distal process; penis without basal prong 11
11. Apical and marginal areas of secondary above with large patch of scent-scales; wings with wide, dark outer borders and dark veins on a light ground; dorsal margin of harpé with a spined pad at about one-third ..... *Pareronia*

Apical and marginal area of secondary above without sex-patch; wings without wide, dark outer borders and heavily dark veins on a light ground; dorsal margin of harpé simple ..... *Nepheronia*

12a. M_1 arising from cell; or, if short-stalked on $R_3 + R_{4+5}$, with third joint of palpus very short, oval 12b

M_1 stalked on $R_3 + R_{4+5}$; third joint of palpus more than twice as long as broad 13

12b. M_1 from cell connate with $R_3 + R_{4+5}$; *mdc* of secondary less than half as long as *ldc* ..... *Colotis*

M_1 arising separate from $R_3 + R_{4+5}$; *mdc* of secondary nearly equal to *ldc* ..... *Eucheira*

13. One radial arising from cell of primary ..... *Archonias*

Two radials arising from cell of primary 14

14. R_3 and R_{4+5} very long-stalked, the veins themselves very short 15

R_3 and R_{4+5} shorter-stalked, the veins themselves long 23

15. M_2 of primary stalked ..... *Baltia*

M_2 of primary arising from cell 16

16. Apex of primary long and pointed; male with a long hair-pencil on 8th abdominal tergite, and another from intersegmental membrane between 8th abdominal sternite and saccus ..... *Saletara*

Apex of primary normal; male with no hair-pencil 17

17. M_2 from cell connate with $R_3 + R_{4+5} + M_1$ ..... *Piercolias*

M_2 from cell separate from $R_3 + R_{4+5} + M_1$ 18

18. *ldc* of primary straight or nearly straight 19

ldc of primary curved or angled to at least 160° 21

19. Fore metatarsus longer than fore tibia; apex of primary rounded; free part of uncus very long and slender; Neotropical ..... *Itaballia*

Fore metatarsus shorter than fore tibia; apex of primary more pointed; free part of uncus short; Holarctic & Ethiopian 20

20. R_2 running parallel with costa for its outer half, ending well beyond fork of R_3 and R_{4+5}; saccus extremely short. *Dixeia*

R_2 not running parallel to costa for any great distance, ending before fork of R_3 and R_{4+5}; saccus longer ..... *Pieris*

21. Humeral straight, bent only at tip 22

Humeral strongly bent distad from very near its base ..... *Ascia*

22. Humeral angle of secondary strongly expended; harpé with a distal process; uncus slender; Indo-Australian. *Leuciacria*

Humeral angle of secondary not strongly expanded; end of harpé simple; uncus thickened dorso-ventrally; Neotropical ..... *Leptophobia*

23. Humeral bent sharply distad from near its base 24
Humeral straight, bent near tip if at all 31

24. Male with a strong hair-pencil arising from the intersegmental membrane between 8th abdominal sternite and saccus. *Appias*
Male with no hair-pencil 25

25. Costa of primary heavily spinulated ..... *Prioneris*
Costa of primary not spinulated, or very lightly 26

26. *mdc* of primary straight, as long as or longer than *ldc* 27
mdc of primary curved, (sometimes straight) much shorter than *ldc* 28

27. Base of R_2 much nearer base of R_1 than end of cell; angle between *ldc* and *m–cu* cross-vein of primary less than 90°. *Belenois*
Base of R_2 about equidistant from base of R_1 and end of cell; angle between *ldc* and *m–cu* cross-vein of primary greater than 90° ..... *Melete*

28. M_1 stalked on R-stem of primary for a distance from the cell of about one-fifth the length of R_{4+5} ..... *Ixias*
M_1 stalked on R-stem for a distance from the cell greater than one-third the length of R_{4+5} 29

29. R_s of secondary from slightly beyond the middle of the cell; M_1 of primary stalked for a distance from the cell of about one-third the length of R_{4+5} ..... *Aoa*
R_s from two-thirds the length of the cell or more; M_1 of primary stalked for a distance from the cell of more than three-quarters the length of R_{4+5} 30

30. Base of R_2 nearer to end of cell than to base of R_1; R_{4+5} running to outer margin just below apex; harpés strongly hairy; uncus without a dorsal keel ..... *Udaiana* (*cynis*)
Base of R_2 about equidistant from base of R_1 and end of cell; R_{4+5} running to apex; harpés not strongly hairy; uncus with a strong dorsal keel ..... *Cepora* (*Huphina*)

31. *mdc* of primary about equal in length to *ldc;* humeral vein curved slightly basad; uncus very short, tegumen large ... 32
mdc of primary shorter than *ldc;* humeral vein straight; uncus not very small and tegumen very large and broad 33

32. *mdc* of secondary shorter than *ldc;* penis shorter than tegumen + uncus ..... *Neophasia*
mdc of secondary usually about equal to *ldc;* penis longer than tegumen + uncus ..... *Catasticta*

33. Apex of primary rounded; palpus short, with very long hairs; Old World ..... *Aporia*
Apex of primary more pointed; palpus longer, with shorter hairs; New World ..... *Tatochila*

SYSTEMATIC AND PHYLOGENETIC DISCUSSIONS OF GENERA AND SUBGENERA; SPECIES LISTS

In the following section the genera are arranged and numbered as in the checklist of genera. Under the heading of each genus the data are arranged as follows:

1. Generic and subgeneric names, and synonyms, with reference to the original publication of each name, its genotype, and reference to the designation of the genotype.
2. Lists of generic and subgeneric characters.
3. Key to subgenera, if given.
4. List of species examined in preparation of this paper. Those of which the genitalia were examined are marked with an asterisk (*).
5. Discussion of synonomy and phylogeny.

Except in the cases of *Delias, Phoebis* and *Eurema* the specific synonomy of Seitz, Macrolepidoptera of the World has been followed, unless some mistake in that work was very evident. In the three genera cited above the more recent revisions of Talbot, Brown and the present author have been followed.

Keys to subgenera have been omitted in small genera where the lists of subgeneric characters are sufficient.

In citing the designations of the genotypes the following abbreviations have been used:

"des." designated by (type by subsequent designation).
"des. in O. D." designated in original description of genus (type by original fixation).
"sole sp." or "sole sp. in O. D." the genus was proposed with a single original species (monotypical genus).

1. PSEUDOPONTIA Ploetz ('70) p. 348, *paradoxa* Felder, sole sp.
Globiceps Felder ('69) p. "30," *paradoxa* Felder, sole sp. (nec *Globiceps* Lep.-Serv. 1825).
Gonophlebia Felder ('70) p. 95, *paradoxa* Felder, sole sp.

Generic characters:

Antennae short with scarcely any distinct club; palpi short, apparently two-jointed, with basal patch about three-quarters

the length of the first joint; tarsi without paronychia; wings rounded, very thinly scaled; primary with apex and outer margin strongly rounded; R_1 and R_2 from the cell; R_3, R_4 and R_5 fused; M_1 and M_2 stalked on R_{3+4+5}; cell very short; secondary with $Sc + R_1$ and R_8 bent strongly to touch each other at about one-third; M_1 and M_2 stalked; cell very short; penis long, thin, straight; harpés fused together along entire ventral and distal margins; tegumen very much reduced; uncus reduced, bifurcate, a fork on either side of anus.

Species examined:

* *paradoxa* Felder.

Many authors have disagreed about the taxonomic position of *Pseudopontia,* some even claiming that it is not a butterfly at all. However the pupa (see Talbot, '28a), the absence of an epiphysis on the fore leg, the cleft tarsal claws and the structure of the male genitalia appear to the author to constitute a set of characters that definitely warrant the inclusion of this anomalous insect in the family *Pieridae.* The genitalia show characters very similar to those of the *Dismorphiinae* while the venation resembles that of the *Pierinae* as much as it resembles that of any other butterflies. A separate subfamily is undoubtedly justified, with the characters given above for the genus.

In the phylogenetic chart of the *Pieridae* (Fig. 99) an origin close to that of the *Dismorphiinae* has been shown. The author's reason for this is that he considers the similarity in fundamental structure of the genitalia to be of greater significance than the similarity of the venation to that of the *Pierinae.*

There is a peculiar tangle in the synonomy. The first generic name applied, *Globiceps* Felder, was a homonym. According to Scudder ('75, p. 259) *Pseudopontia* Ploetz was published in September, 1870 and *Gonophlebia* Felder in August, 1870, giving precedence to the latter name. According to Aurivillius ('98, p. 386) *Pseudopontia* was published in April, 1870, and *Gonophlebia* in June, 1870, giving precedence to the former. The present author has followed Aurivillius.

2. LEPTIDIA Dalman ('20) p. 76, *sinapis* L. sole sp.
   Leucophasia Stephens ('28), I, p. 24, *sinapis* L. sole sp.
   Leptoria Stephens ('34), IV, p. 404, *sinapis* L. sole sp.
   Azalais Grote ('00) p. 13, *gigantea* Leach des. in O D.

Generic characters:

Wings white; palpi with third joint very short; paronychia narrow; antennal club distinct, abrupt; cell of both wings very short; primary with all five radials present and stalked, M_1, M_2 and M_3 all from the cell separately; secondary with humeral

well developed, "T"-shaped, R_s and M_1 long stalked, M_2 and M_3 from the cell separately; penis about twice as long as harpé, slightly curved, much thicker at base; saccus about as long as harpé; two lobes of uncus heavily chitinized and hooked dorsad at tip; penis sheath and transtilla well developed; harpés fused for almost entire ventral and distal margins, with two heavily chitinized distal processes, the lower the longer.

Species examined:

* *duponcheli* Staudinger.
* *sinapis* L. (various forms).
* *gigantea* Leech.

Both venation and genitalia show *Leptidia* to be undoubtedly closely allied to the New World genera here included in the *Dismorphiinae*. The synonomy is rather involved, with some points still in doubt. Various authors have claimed that Dalman's genera in Billberg's Enumeratio are invalid through not having been sufficiently characterized. Such claims fail to take into account the wording of Article 25 of the Code which definitely states ". . . That (prior to January 1, 1931) this name was published and accompanied by an indication, or a definition, or a description; . . .". The two uses of the word "or" seem to make it clear that in the erection of a new genus an "indication" alone is to be considered sufficient to validate the name. In the original description of *Leptidia*, Dalman definitely cited *sinapis* L. as composing his new genus. That is certainly sufficient indication of the limits and inclusiveness of the genus. Arguments as to whether Dalman actually meant *sinapis* L. or some other hypothetical species which was not *sinapis* L. have no status. Under the Code the genus *Leptidia* must stand, with *sinapis* L. as the genotype, as Dalman's paper probably antedates the signature of the Verzeichniss in which *Leptosia* was published.

The reference for the original description of *Leptoria* Stephens is cited from a paper by Walsingham and Durrant. The present author has not been able to examine the original.

Azalais, erected by Grote for *gigantea* Leach, does not seem worth retention. The venation characters cited by the author are slight and evanescent.

3. PSEUDOPIERIS Godman & Salvin ('89), p. 187, *nehemia* Boisduval, des. in O. D.

Generic characters:

Wings white; no prominent sex-patches on secondary of male; third joint of palpus short; antenna short; primary with

all five radials present, long-stalked, the base of the free part of R_1 being a third of the distance from the end of the cell to the apex, M_1 well stalked on $R_1 + R_2 + R_3 + R_4 + R_5$; secondary with humeral long, turned distad; R_s and M_1 long-stalked, *mdc* three to four times as long as *ldc;* penis at least three times as long as harpé, not swollen at base, curved; saccus less than half as long as penis; lobes of uncus heavily chitinized at extreme tip, not hooked dorsad; penis sheath and transtilla well developed; harpé with a single distal process, well developed, heavily chitinized at extreme tip, located as far dorsad as penis sheath.

Species examined:

* *nehemia* Boisduval.

* *penia* Hopffer.

Pseudopieris appears worthy of separation as a distinct genus. In venation it may be regarded as slightly less primitive than *Dismorphia* in that M_1 of the primary is consistently stalked. The species show no evidence of the riot of "mimicry" and development of immense sex-patches characteristic of the species of *Dismorphia.*

4. DISMORPHIA Huebner ('16) p. 10, *laia* Huebner, des. Butler ('70)

Leptalis Dalman ('23) p. 40, *astynome* Delman, des. in O. D.[1]

Hemerocharis Boisduval ('36) p. 412, as Ms. synonym of *Leptalis* Dalman

Subg. ACMEPTERON Godman & Salvin ('89) p. 179, *nemesis* Latreille, des. in O. D.

Subg. ENANTIA Huebner ('16) p. 96, *licinia* Huebner, des. Scudder ('75)

Licinia Swainson ('20) I, (1), p. 15, *melite* L. sole sp.

Enantia Godman & Salvin ('89) p. 174, 181, *melite* L. des. Godman & Salvin l. c.

Subg. MOSCHONEURA Butler ('70) p. 54, *methymna* Godart, des. in O. D.

Subg. nov. **Patia,** type *Leptalis orise* Boisduval, see below

Generic characters, Dismorphia:

Characters of the subfamily; antennae proportionately longer than in *Pseudopieris;* male with a large sex-patch on the under side of the primary and another on the upper side of the secondary; primary with M_1 usually from cell but sometimes stalked; secondary with R_s and M_1 usually stalked, *mdc* more than twice as long as *ldc;* cells of both wings long; transtilla

[1] *Fide* Scudder ('75).

and penis sheath well developed; harpé with only one definite distal process.

Subgeneric characters, Dismorphia:

Apex of primary rounded or, if long and pointed, falcate; primary with M_1 from cell; secondary with R_s and M_1 stalked; last abdominal segment entire; penis more than twice as long as harpé, gently curved, little swollen at base; tip of ejaculatory duct not swollen, with a considerable number of cornuti; harpé with short distal process; saccus longer than harpé.

Subgeneric characters, Acmepteron:

Apex of primary long and pointed, not falcate; primary with M_1 from cell; secondary with R_s and M_1 connate from cell; last abdominal segment entire; penis more than three times as long as harpé, slender, gently curved, slightly swollen at base; tip of ejaculatory duct not swollen, with a considerable number of cornuti; harpé with a short distal process; saccus longer than harpé.

Subgeneric characters, Enantia:

Apex of primary rounded; primary with M_1 from cell; secondary with R_s and M_1 stalked, *mdc* long, very straight; last abdominal segment deeply cleft, the lateral lobes slender and pointed; penis more than three times as long as harpé, slender, gently curved, little swollen at base; tip of ejaculatory duct slightly swollen, with 6 or more cornuti; penis sheath long, its ventral margin produced distad to form a long spur; distal process of harpé short; saccus longer than harpé.

Subgeneric characters, Moschoneura:

Apex of primary strongly rounded; primary with M_1 well stalked on R-stem; secondary with R_s and M_1 stalked; last abdominal segment entire; penis very long and slender, more than four times as long as harpé; tip of ejaculatory duct not swollen, with a considerable number of cornuti; penis sheath normal; distal process of harpé short; saccus long and slender, more than twice as long as harpé.

Subgeneric characters, Patia, *subgenus nov.:*

Apex of primary strongly rounded, outer margin somewhat concave; primary with M_1 from cell; secondary with R_s and M_1 stalked; last abdominal segment entire; penis about twice as long as harpé, strongly curved, considerably swollen at base; tip of ejaculatory duct swollen; with not more than three strong cornuti; distal process of harpé long and slender; saccus much shorter than harpé.

KEY TO SUBGENERA

1. Last abdominal segment deeply cleft ..... *Enantia*
   Last abdominal segment entire 2
2. R_s and M_1 of secondary stalked 3
   R_s and M_1 of secondary from cell ..... *Acmepteron*
3. M_1 of primary stalked beyond base of R_1; saccus and penis very long ..... *Moschoneura*
   M_1 of primary from cell; saccus and penis shorter 4
4. Distal process of harpé a long spine; saccus shorter than harpé ..... Patia
   Distal process of harpé short; saccus much longer than harpé. *Dismorphia*

Species examined:

D. (*Dismorphia*)

* *amphione* Cramer
* *arcadia* Felder
* *astynome* Dalman
avonia Hewitson
* *carthesis* Hewitson
cubana Herrich-Schaeffer
* *discrepans* Butler
foedora Lucas
* *fortunata* Lucas
* *lewyi* Lucas
* *lygdamis* Hewitson
* *lysis* Hewitson
* *medora* Doubleday
melia Godart
pallidula Butler
pimpla Hopffer
rhomboidea Butler
* *spio* Godart
* *teresa* Hewitson
* *thermesina* Hopffer
virgo Bates
* *zaela* Hewitson

D. (*Acmepteron*)

* *nemesis* Latreille

D. (*Enantia*)

* *cornelia* Felder
* *licinia* Huebner
* *limnorina* Felder
* *melite* L.
psamathe Fabricius
* *theugenis* Doubleday

D. (*Moschoneura*)

* *pinthaeus* L.

D. (Patia)

myris Godman & Salvin
* *orise* Boisduval
* *sororna* Butler

Licinia Cramer was designated as the genotype of *Enantia* Huebner by Scudder in 1875, so that the subsequent designations of *melite* L. by Godman and Salvin (*l. c.*) and Roeber ('10, p. 98) are invalid.

It is evident that in view of the great amount of mimicry that has occurred among the species of *Dismorphia* little reliance can be

placed on superficial characters for generic and subgeneric classification. The classification here adopted seems to be along natural lines. It is possibly a bit of a surprise that species like *thermesina* and *fortunata* should belong in *Dismorphia* rather than in *Enantia* and *Moschoneura* respectively, but the evidence from the venation and genitalia is too definite for any other interpretation.

Work on the early stages of *Dismorphia* is very badly needed. The author is not aware of a single life history in the genus having been published.

5. EROESSA Doubleday ('46) p. 56, *chilensis* Blanchard, sole sp.

Generic characters:

Palpi with third joint long; primary with all five radials present, R_1 and R_2 from cell, R_3, R_4 and R_5 long stalked, M_1 from cell with short *udc, mdc* and *ldc* straight, nearly equal; secondary with humeral long, slightly curved basad at tip, *mdc* about two-thirds as long as *udc* and half as long as *ldc,* 3d A short, little more than half as long as 2d A; penis about as long as harpé, lightly bent, with no basal prong; saccus shorter than tegumen; articulatory process of tegumen large; uncus about half as long as tegumen, with a pair of dorsad projecting knobs at its base; juxta well developed, rounded caudad; clasper large with a strong point projecting dorsad above margins of harpés; harpé with a distal process consisting of a patch of heavy setae.

Species examined:

* *chilensis* Blanchard.

Possessing as it does a well developed clasper, five radials and M_1 of the primary from distinctly below the R-stem, *Eroessa* represents an extremely primitive type. In none of the other *Pieridae* are all three of these primitive characters present. *Eroessa* may be regarded as ancestral, to a certain degree, to the other Euchloini. The long third joint of the palpus is probably also to be regarded as primitive. In the other genera of the Euchloini, with the exception of *Hesperocharis,* this joint is considerably shorter.

6. ANTHOCHARIS Boisduval ('32) pl. 5, fig. 6, 7, *cardamines* L. des. Scudder ('75)

Mancipium Stephens ('28), *cardamines* L. des. Westwood ('40) (nec *Mancipium* Huebner, 1819)

Tetracharis Grote ('98) p. 37, *cethura* Felder sole sp. and des. in O. D.

Subg. FALCAPICA Klots ('30) p. 83, *genutia* Fabr. des. in O. D.

Midea Herrich-Schaeffer ('67) ii, p. 16, *genutia* Fabr., sole sp. (nec. *Midea* Bruzelius 1854)

Generic characters, Anthocharis:

Males with apex of primary usually with an orange patch; antennae short with abrupt club; third joint of palpus short, oval; primary with five radials (usually), R_1 and R_2 from cell, R_3, R_4 and R_5 stalked, M_1 stalked on R-stem, *mdc* shorter than *ldc;* secondary with humeral vein long, straight, very slightly curved basad at extreme tip, R_s, M_1 and M_2 all from cell separately; penis about as long as harpé, curved near base, with no basal prong; saccus thick, about as long as tegumen; tegumen with small articulatory process; uncus simple, curved; juxta small, triangular, flat or slightly curved; harpé simple with dorsal margin evenly curved, bearing no structures; clasper simple, rounded.

Subgeneric characters, Anthocharis:

Apex of primary rounded, never falcate.

Subgeneric characters, Falcapica:

Apex of primary falcate, sometimes strongly so.

Species examined:

A. (*Anthocharis*)

* *cardamines* L.
* *gruneri* Herrich-Schaeffer
* *damone* Boisduval
* *eupheno* L.
* *euphenoides* Staudinger
* *sara* Boisduval
* *cethura* Felder
* *pima* Edwards

A. (*Falcapica*)

* *bieti* Oberthür
* *genutia* Fabricius
* *lanceolata* Boisduval
* *scolymus* Butler

With the formal invalidation of Huebner's Tentamen, *Mancipium* Huebner of the Tentamen ceases to have any status in nomenclature, so that the next subsequent usage of *Mancipium* is the official first publication of the name. This is, in all probability, that of Huebner in the Exotische Schmetterlinge, and the usage is, in the present author's estimation, perfectly valid. In this case *cardamines* was not included, so that Westwood's action in specifying this species as the type of *Mancipium* Huebner was incorrect. This being the case the type of *Mancipium* must be *monuste* L., as recently (Entomologist, 64: 272–273) designated by Hemming, whose wise action thus removes a bone of contention from this portion of the nomenclature. *Mancipium* Stephens, with type *cardamines* as designated by Westwood, must, of course, remain as a synonym of *Anthocharis.*

The genus has been more extensively treated by the present author in a previous paper (Klots, '30). As stated there, the author and others have found the venation to be in many respects

so variable as to render it not entirely trustworthy as a taxonomic character.

The trend of development in the Euchloini has also been treated in greater detail by the writer in the article referred to. The main line of development appears to have been along the line of simplification of the genitalia, correlated with a reduction in the number of the radials. *Anthocharis* shows the extreme of reduction of the genitalia, but is still in a more or less intermediate condition as regards the number of the radials, as is evidenced by the fact that some of the species possess five, others vary between four and five, and others regularly possess but four.

7. ZEGRIS Rambur ('36) p. 573, *eupheme* Esper sole sp.
Subg. MICROZEGRIS Alpheraky ('13), *pyrothoë* Eversmann, sole sp.
Pyrothoia Verity ('29) p. 348, *pyrothoë* Eversmann, sole sp.

Generic characters, Zegris:

Apex of primary of male with a usually narrow orange patch; antennae very short, with abrupt club; palpi very hairy; primary with 4 or 5 radials, M_1 stalked on R-stem, M_2 from cell well below $R_{3+4+5} + M_1$; secondary with R_s, M_1 and M_2 all separate, *ldc* much longer than either *udc* or *mdc;* penis short, lightly bent near base, with no basal prong; saccus very short and thick, shorter than uncus; articulatory process of tegumen small; juxta small, triangular, flat or slightly curved; dorsal margin of harpé produced dorsad at about middle to form a triangular flap or tooth, clasper simple, rounded, sometimes slightly produced dorsad.

Subgeneric characters, Zegris:

Primary with 5 radials; M_1 stalked on R-stem usually more than halfway from cell to base of R_3; R_2 usually stalked on $R_3 + R_4 + R_5 + M_1$; triangular flap on dorsal margin of harpé larger than in *Microzegris;* clasper somewhat narrowed at middle; saccus very short, little if any longer than thick.

Subgeneric characters, Microzegris:

Primary with 4 radials, R_4 and R_5 having united; M_1 stalked on $R_3 + R_{4+5}$ usually less than halfway from cell to base of R_3; R_2 usually arising from cell; dorsal margin of harpé at middle bearing a very small tooth; clasper very slightly narrowed at middle; saccus considerably longer than thick.

Species examined:

Z. (*Zegris*).
* *eupheme* Esper.
* *fausti* Christoph.

Z. (*Microzegris*).
* *pyrothoë* Eversmann.

As previously stated by the author ('30) there is some doubt that the peculiar characters cited by Rambur for the larva and pupa of *eupheme* are accurate. Some work on this subject is greatly to be desired. *Zegris* appears genitalically to represent more or less of a transitional form between *Euchloë* and *Anthocharis.* Venationally *pyrothoë* has developed to a point where the fusion of R_4 and R_5 is complete and constant.

8. EUCHLOË Huebner ('16) p. 94, *belia* Cramer, des. Butler ('70)
Subg. ELPHINSTONIA Klots ('30) p. 87, *charlonia* Donzel des. in O. D.
Phyllocharis Schatz ('92) p. 71, *tagis* Huebner des. in O. D. (nec *Phyllocharis* Dalman 1824).

Generic characters, Euchloë:

Apex of primary never with orange patch; primary normally with 5 radials; antennae short (longer than in *Zegris*) with abrupt club; third joint of palpus proportionately longer than in *Anthocharis* and *Zegris;* primary with M_1 normally stalked halfway from cell to base of free part of R_3, *mdc* very short; dorsal margin of harpé at about middle with a strong pointed flap or tooth; penis strongly curved near base; saccus always longer than thick.

Subgeneric characters, Euchloë:

Dark markings of secondary beneath not normally so heavy as to cover practically all of wing; pointed flap on dorsal margin of harpé long, heavily chitinized, projecting dorsad then bent mesad and ventrad with termination between harpés; penis not so strongly bent near base as in *Elphinstonia,* with no basal prong; larva apparently not so strongly tuberculate as larva of *Elphinstonia.*

Subgeneric characters, Elphinstonia:

Dark markings of secondary beneath heavy, often covering practically all of wing; pointed flap on dorsal margin of harpé shorter and less heavily chitinized than in *Euchloë,* extending above dorsal margin of harpé, not bent mesad and ventrad; penis very strongly bent basally, with a short blunt basal prong; larva apparently more heavily tuberculate than larva of *Euchloë.*

Species examined:

E. (*Euchloë*).
* *ausonides* Boisduval.
* *belemia* Esper.

* *belia* Cramer.
* *creusa* Doubleday & Hewitson.
* *daphalis* Moore.
* *falloui* Allard.
* *olympia* Edwards.
* *orientalis* Bremer.
E. (*Elphinstonia*).
* *charlonia* Donzel.
* *tagis* Huebner.

Euchloë, like *Anthocharis* and *Zegris,* shows considerable individual variation in venation. The genitalic characters appear more trustworthy.

9. HESPEROCHARIS Felder ('62) p. 493, *erota* Lucas, des. Butler ('70)
Heliochroma Butler ('69) p. 15, *idiotica* Butler des. in O. D.
Subg. CUNIZZA Grote ('00) p. 35, *hirlanda* Stoll, des. in O. D.
Cathaemia auct. nec Huebner
Subg. MATHANIA Oberthür ('90) p. xx, *esther* Oberthür, type not previously designated

Generic characters, Hesperocharis:

Antennae rather short with club more gradual; palpi with long slender third joint; primary with four radials, R_1 from cell, R_2 apparently missing, R_3, R_4 and R_5 stalked, M_1 from cell, *udc* shorter than *mdc, mdc* half or less the length of *ldc;* secondary with humeral long, bent slightly basad, R_8, M_1 and M_2 all from cell, well separated; penis about as long as harpé, slightly bent near base, with basal prong; saccus shorter than tegumen; articulatory process of tegumen well developed; uncus short, stout, with a pair of dorso-lateral protuberances at its base and a chitinized area (scaphium?) in anal membrane immediately below it and above anus; juxta well developed, hollowed-out; clasper well developed, somewhat produced dorsad; harpé simple, with a well chitinized area in inner membrane below articulation with tegumen.

Subgeneric characters, Hesperocharis:

Palpus less hairy than in *Mathania;* primary without a short spur into the cell from slightly above middle of *mdc,* and free part of R_5 never twice the length of the distance from the fork of R_3 and R_{4+5} to the fork of R_4 and R_5; cell of primary narrow; apex of primary more acute than in *Cunizza;* secondary usually more or less produced in the region of the tip of Cu_2,

but never with a sharp tail there; saccus shorter than in *Cunizza;* tip of uncus blunt.

Subgeneric characters, Cunizza:

Palpus less hairy than in *Mathania;* primary without a short spur into cell from *mdc,* and with free part of R_5 twice as long as the distance from the fork of R_3 and R_{4+5} to the fork of R_4 and R_5; cell of primary narrow; apex of primary rounded; secondary with rounded anal angle; saccus longer than in *Hesperocharis* and *Mathania;* tip of uncus blunt.

Subgeneric characters, Mathania:

Palpus much hairier than in *Hesperocharis* and *Cunizza:* primary with a short spur into cell from slightly above middle of *mdc;* free part of R_5 never twice as long as distance from fork of R_3 and R_{4+5} to fork of R_4 and R_5; cell of primary broader than in *Hesperocharis* and *Cunizza;* apex of primary acute; secondary with a sharp tail at anal angle; tip of uncus more slender than in *Hesperocharis* and *Cunizza.*

Key to Subgenera

1. Palpus very hairy; a short spur into cell from *mdc* of primary; anal angle of secondary acute ..... *Mathania*
   Palpus less hairy; no spur into cell fron *mdc* of primary; anal angle of secondary not acute 2
2. Free part of R_5 of primary twice or more the length of distance from fork of R_3 and R_{4+5} to fork of R_4 and R_5; apex of primary rounded ..... *Cunizza*
   Free part of R_5 of primary never twice the length of distance from fork of R_3 and R_{4+5} to fork of R_4 and R_5; apex of primary more acute ..... *Hesperocharis*

Species examined:

H. (*Hesperocharis*).
- * *anguitia* Godart.
- * *coloë* Fruehstorfer.
- * *costaricensis* Bates.
- * *erota* Lucas.
- * *idiotica* Butler.
- * *leucothea* Molina.
- * *marchalii* Guerin.
- * *nera* Hewitson.
- * *nereina* Hopffer.

H. (*Cunizza*).
- * *hirlanda* Stoll (various subspecies).

H. (*Mathania*).
- * *agasicles* Oberthür.

The genus *Hesperocharis* as here held to be composed of the three genera *Hesperocharis, Cunizza* and *Mathania* may at first

glance seem too heterogeneous. When, however, the venation and structural characters are analyzed; it is apparent that the former separations of these genera have been based upon very superficial characters, and that in a broad classification their positions as even subgenera are none too secure. The differences in venation are relatively very slight; the hairier palpi of *Mathania* are hardly to be considered as very significant characters; and omitting the differences in wing shape, a rather mutable character, there remain only pattern characters which are hardly of the caliber required for generic or even subgeneric separation. However, to avoid too great changes in nomenclature, subgeneric rank has here been awarded.

Cathaemia Huebner has been used by many authors for the species here placed under the name *Cunizza*. The type of *Cathaemia* is *caenaeus* L. designated by Scudder ('75), so that this name must be placed under *Delias, q. v.*

There seems little reason for thinking that the grouping of *Hesperocharis* with *Eroessa, Euchloë*, etc., is not natural. Because of the loss of R_2 and the peculiar genitalic structures *Hesperocharis* has evidently developed to some extent on a line of its own. The genitalia of the three subgenera are very similar to each other, and very different from those of any other *Pieridae*, so much so that the author feels no reason to suspect that this similarity may be due to convergence.

10. PINACOPTERYX Wallengren ('57) p. 7, *eriphia* Godart des. Scudder ('75)

Herpaenia Butler ('70) p. 38, 52, *eriphia* Godart (as *tritogenia* Klug) des. in O. D.

Picanopteryx Scudder ('75), *eriphia* Godt. des. Scudder, *l. c.*

Generic characters:

Small to medium sized butterflies, primary not over 35 mm. in length; antennae less than half as long as primary, with abrupt club; palpus with third joint short, oval; light ground color of wings largely obscured by a heavy and peculiar pattern of dark markings; primary with four radials, R_1 and R_2 arising from the cell, R_3 and R_{4+5} stalked, M_1 stalked on $R_3 + R_{4+5}$, M_2 from cell with *mdc* less than one-quarter the length of *ldc;* secondary with humeral short, slightly curved distad, R_s, M_1 and M_2 from cell separately, *mdc* very short, cell less than half the length of the wing; penis considerably longer than harpé, with short blunt basal prong, gently curved; saccus

shorter than tegumen; articulatory process of tegumen very small; a saddle-like protuberence on dorsum of end of tegumen; uncus more than half as long as tegumen, slightly curved, blunt; no subscaphium; juxta very small, flat; harpé simple, with rounded end; clasper large, thin, with a dorsal point.

Species examined:

* *eriphia* Godart.

* *lacteipennis* Butler.

Scudder's designation of *eriphia* as the genotype of *Pinacopteryx* must hold unless some earlier designation be found. *Herpaenia* Butler is therefore placed as a synonym. *Pinacopteryx* has here been placed in the *Euchloini* because of the possession of a clasper. The author feels that this classification is not natural, but does not consider that any other characters warrant the placing of this genus anywhere else. The peculiar pattern may have some mimetic significance. The short third joint of the palpus may have been accidentally developed or may be considered another bit of evidence of Euchloine relationship.

11. HEBOMOIA Huebner ('16) p. 96, *glaucippe* L., des. Butler ('70)

Iphias Boisduval ('36) I, p. 595, *glaucippe* L.

Generic characters:

Size large, primary more than 40 mm. long; antennae less than half as long as primary, with gradual club; palpus with short oval third joint, with not very long bristly hairs; primary with R_1 and R_2 from cell close together, running almost parallel and close together for most of their length, R_3 and R_{4+5} long-stalked, M_1 from cell with short *udc*, *mdc* about half as long as *ldc* which is angled; secondary with humeral long, bent sharply distad from one-third to one-quarter, R_s, M_1 and M_2 from cell separately; penis about as long as harpé, slightly recurved, without basal prong; saccus about as long as tegumen, slender; articulatory process of tegumen large; uncus short, curved, bifurcate; a well chitinized area immediately beneath base of uncus (scaphium?) and above anus; juxta well developed, hollowed out; harpé with a dorsal process and a distal process; clasper medium sized, located toward base of harpé, with a dorsal point.

Species examined:

* *glaucippe* L. (various subspecies).

Hebomoia shares with *Hesperocharis* alone of the *Pieridae* the possession of a structure above the anus very similar to some form

of the scaphium. With others of the *Euchloini* it shares the short third joint of the palpus, and with all the other *Euchloini* it possesses a well developed clasper. As previously stated, the author does not regard the Euchloini as here delineated as being an entirely natural group, but in view of the known facts such a grouping seems to do about as well as any.

12. [2] COLIAS Fabricius ('07) 6: 284, *hyale* L. (see below)
Eurymus Swainson ('29) p. 129, 134, *hyale* L. sole sp. (nec *Eurymus* Rafinesque, 1815)
Eriocolias Watson ('95) 28: 166, *edusa* Fabr., des. in O. D.
Scalidoneura Butler ('71) p. 250, *herminia* Butler sole sp. in O. D.
Subg. ZERENE Huebner ('16) p. 97, *caesonia* Stoll., des. Scudder ('72)
Megonostoma Reakirt ('63) p. 356, *caesonia* Stoll., des. Butler ('70)

Generic characters:

Medium sized (primary not over 35 mm.) butterflies, the ground color of the wings white, yellow or orange; antenna short, with gradual club; palpus with short, oval third joint; tarsus with neither pulvillus nor paronychia; primary with four radials, R_1 from cell, R_3 and R_{4+5} long stalked, M_1 stalked more than one-third from cell to apex, *mdc* half or less the length of *ldc;* secondary with humeral nearly or entirely absent, R_s, M_1 and M_2 from cell separately; penis long, strongly curved, with long basal prong; saccus thick; tegumen with a mid-dorsal lobe and small articulatory process, shorter than uncus; uncus short, slightly curved, free part half or more its length; juxta filiform, recurved cephalad, supporting "anellus," expanded at tip; harpé higher than long.

Subgeneric characters, Colias:

Apex of primary more or less rounded, never acute, outer margin of primary somewhat convex; R_2 normally stalked on $R_3 + R_{4+5} + M_1$; tip of penis flattened dorso-ventrally, with a number of fine teeth; saccus shorter than tegumen + uncus; mid-dorsal lobe of tegumen long; harpé very much higher than long, without a rounded finely-toothed distal process.

[2] Just as this goes to press Heming (Entomologist, Vol. 64, No. 823, p. 272–273) has ignored both *Scalidoneura* and *Eriocolias,* as well as the possibility of *Colias* and *Zerene* being congeneric, and proposed the generic name *Coliastes* for this group. His name is, of course, a synonym of *Colias, Zerene,* or *Scalidoneura,* whichever is eventually decided upon.

Subgeneric characters, Zerene:

Apex of primary acute, outer margin straight or slightly concave; R_2 arising from cell; tip of penis not strongly flattened dorso-ventrally, without teeth; saccus longer than tegumen + uncus; harpé nearly as long as high, with a rounded finely-toothed distal process, its dorsal margin not swollen.

Species examined:

C. (*Colias*).

alpherakii Staudinger.
aurora Esper.
aurorina Herrich-Schaeffer.
* *alexandra* Edwards.
* *behrii* Edwards.
caucasica Staudinger.
christina Edwards.
christophi Grum-Grshmaïlo.
chrysotheme Esper.
cocandica Erschscholtz.
* *dimera* Doubleday & Hewitson.
* *edusa* Fabricius.
electo L.
eogene Felder.
* *erate* Esper.
* *eurytheme* Boisduval.
euxanthe Felder.
fieldii Menetries.
harfordi Henry Edwards.
hecla Lefebre.
* *hyale* L.
* *interior* Scudder.
* *meadii* Edwards.
melinos Eversmann.
montium Oberthür.
myrmidone Esper.
nastes Boisduval.
occidentalis Scudder.
palaeno L.
pelidne Boisduval.
phicomene Esper.
* *philodice* Godart.
romanovi Grum-Grshmaïlo.
sagartia Lederer.
* *scudderi* Reakirt.
siphanica Grum-Grshmaïlo.
thisoa Menetries.
vautieri Guerin.

C. (*Zerene*).
* *caesonia* Stoll.
cynops Butler.
* *eurydice* Boisduval.

Here again as in the case of *Anthocharis* the author has retained a name which according to the Code should not be used. Regardless of various arguments to the contrary the genotype of *Colias* was fixed by Latreille ('10, p. 440) as *rhamni* L. The next subsequent designation of a type for *Colias* was Leach's restriction of the name to *hyale* ('15, p. 716). If the Code is strictly followed in this case it will mean that *Colias* will replace *Gonepteryx* Leach (*q.v.*) and that since *Eurymus* Swainson, a name now used by some authors for this group, is a homonym, *Scalidoneura* Butler will have to be used as the next oldest name. The confusion attendant upon such a proceeding would be too great. *Zerene* Huebner would apply as the generic name for those who accept the present writer's placing of *caesonia* and *hyale* in the same genus, and this would add to the confusion. To be forced to use *Zerene* (*Zerene*) for the *caesonia* species, *Zerene* (*Scalidoneura*) for the *hyale* species and *Colias* for the *rhamni* species would be unbearable.

Latreille's designation of *rhamni* as the type of *Colias* has been questioned. The matter has been covered by Opinion 11 of the International Commission of Zoological Nomenclature.

Colias (as here used), *Catopsilia* and *Anteos* constitute a group of three genera distinguished from all the other Rhodocerini by the presence of a large basal prong on the penis, a short saccus, a mid-dorsal lobe on the tegumen, the absence of swollen wing-cases on the pupa, and other minor characters. Whether this grouping is entirely natural is a matter for discussion. The present author thinks that it is. The matter has been covered by him at greater length (Klots '29b & c).

13. CATOPSILIA Huebner ('16) p. 98, *crocale* L. des. Scudder ('72) p. 37
Murtia Huebner ('16) p. 98, *pyranthe* L. (as *minna* Cramer) sole sp.

Generic characters:

Males with "mealy border" of wings wide, an oval sex-patch on upper side of secondary near base of costal margin and a strong hair-pencil on under side of primary near base of inner margin; antenna short with gradual club; palpus with short oval third joint; tarsus with both pulvillus and paro-

nychia; primary with R_1 from well basad on cell, R_2 from near end of cell, R_3 and R_{4+5} long stalked, M_1 stalked on $R_3 + R_{4+5}$ about a third of the distance from end of cell to apex, M_2 from cell with *mdc* half or more as long as *ldc;* secondary with humeral vein short, curved slightly basad, R_s, M_1 and M_2 from cell separately; penis long, curved, bearing chitinized teeth (not to be confused with *cornuti*), with long basal prong; saccus thick, shorter than tegumen + uncus; tegumen short, with (usually) a mid-dorsal lobe, articulatory process small; uncus slender, free part long; juxta slender, recurved cephalad, expanded at tip; harpé higher than long, with a rounded dorsal process and an angulate or somewhat rounded distal process.

Species examined:

* *crocale* Cramer.
* *etesia* Hewitson.
* *florella* Fabricius.
* *pyranthe* L.
* *scylla* L.
* *thauruma* Reakirt.

The author has figured the genitalia of *Catopsilia* in a previous article ('29c), pointing out at length the reasons for its separation from the New World species placed in *Phoebis.* There seem no valid reasons for holding any subgenera. The relationships of the genus are discussed above under *Colias* and at somewhat greater length in the article cited above.

14. ANTEOS Huebner ('16) p. 99, *maerula* Fabricius, des. Godman & Salvin ('89) p. 148
Amynthia Swainson ('32) p. 65, *maerula* Fabricius des. in O. D. (*fide* Scudder '75)
Subg. RHODOCERA Boisduval & Leconte ('29) p. 70, *menippe* Huebner, des. Butler ('70) p. 35

Generic characters:

Size large, primary more than 40 mm. long; antenna short with gradual club; palpus with short oval third joint; male with a sex patch on upper side of secondary below base of $Sc + R_1$; without hair-pencil on primary; primary with R_1 and R_2 from cell, R_3 and R_{4+5} stalked usually slightly more than half way from end of cell to apex, M_1 stalked on R-stem less than a third way from cell to apex; secondary with humeral vein short, slightly curved basad, R_s, M_1 and M_2 from cell separately; penis little if any longer than ventral margin of harpé, heavy, curved, with two or more chitinized teeth and a strong basal prong; saccus little if any longer than tegu-

men + uncus, thick, swollen distally; tegumen short with mid-dorsal lobe, articulatory process small; uncus slender, curved, with free part long; harpé as high as long, with a simple distal process, a trough-shaped lobe arising at about middle from inner face below dorsal margin, and a rounded setiferous lobe on sacculus.

Subgeneric characters, Anteos:

Apex of primary falcate; secondary with a short pointed tail on M_3, primary with R_2 arising from end of cell or very near end; sex-patch of secondary not reaching costad to $Sc + R_1$; distal process of harpé short; a dorsal setiferous rounded lobe on inner face of harpé basad of middle; a number of small teeth on penis; basal prong of penis longer than trough-shaped dorsal lobe of harpé.

Subgeneric characters, Rhodocera:

Apex of primary not falcate; outer margin of secondary rounded, without tails; primary with R_2 arising from well basad of end of cell; sex-patch of secondary reaching to $Sc + R_1$; distal process of harpé long and pointed; no dorsal setiferous lobe on harpé; two large teeth on penis; basal prong of penis shorter than trough-shaped lobe of harpé.

Species examined:

A. (*Anteos*)
* *clorinde* Godart
* *maerula* Fabricius

A. (*Rhodocera*)
* *menippe* Huebner

The genitalia and other structures of this genus have been figured and more extensively discussed by the author in a previous article ('29b). In that article, however, it was stated that *menippe* was not worthy of subgeneric distinction from the other species. Since then a more intensive study of the Rhodocerini has caused the author to revise this opinion.

As stated by the author in this previous article there is no valid reason whatsoever for including the New World species of *Anteos* in the essentially Old World genus *Gonepteryx*. The resemblance between the species is purely fortuitous and in this way means nothing whatsoever.

15. GONEPTERYX Leach ('15) p. 716, *rhamni* L. sole sp. in O. D.
Gonoptera Dalman ('20) p. 76, *rhamni* L. type not previously specified
Earina Speyer ('39) p. 98, *rhamni* L. type not previously specified

Goniapteryx Westwood ('40) p. 87, *rhamni* L. des. in O. D. (*fide* Scudder, '75)

Gonioptera Wallengren ('53) p. 145, *rhamni* L. type not previously designated

General characters:

Antenna very short with gradual club; palpus with short oval third joint; tarsus with paronychia but without pulvillus; primary with costa strongly bowed before apex, apex acute, falcate; secondary with a sharp short tail on tip of Cu_1; wings without sex-patches or mealy border; primary with R_1 and R_2 from cell, R_2 from well basad of tip, R_3 and R_{4+5} long-stalked, M_1 stalked on $R_3 + R_{4+5}$, M_2 from cell with *mdc* short, about a third as long as *ldc;* secondary with humeral vein very greatly reduced or absent, *mdc* very short, about a fifth as long as *ldc;* penis long, slender, more than three times as long as tegumen + uncus,[8] without basal prong; saccus slender, longer than tegumen + uncus; tegumen very short, without mid-dorsal lobe, articulatory process small; uncus short, slender, sometimes bifurcate; harpé longer than high, with simple distal process, one dorsal spine on inner face near tip and a small triangular spine on ventral edge near tip.

Species examined:

* *alvinda* Blanchard
* *amintha* Blanchard
* *aspasia* Menetries
* *cleobule* Huebner
* *farinosa* Z.
* *rhamni* L.
* *zaneka* Moore

The species of *Gonepteryx* constitute a very homogeneous group, characteristic of and limited to the Palearctic region. As previously stated they bear no relationship to the New World *Anteos.* Any further division of the genus would be unwarranted.

Genitalically *Gonepteryx* appears related to the genera which follow.

The author has already discussed under *Colias* his reasons for retaining the name *Gonepteryx* for the present group, although under the Code this proceeding is incorrect.

16. DERCAS Boisduval ('47b) p. 70, *verhuelli* Hoeven, sole sp.

Generic characters:

Apex of primary acute, falcate; secondary sometimes with a sharp tail on Cu_1; antenna very short, with gradual club; palpus with short, oval third joint; cell of both primary and

secondary short, considerably less than half the length of wing; primary with four radials, R_1 and R_2 from cell, R_2 from end of cell, R_3 and R_{4+5} stalked halfway from cell to apex, M_1 stalked more than halfway from end of cell to fork of R_3 and and R_{4+5}, *mdc* about half as long as *ldc;* secondary with humeral vein very short, *udc* about equal to *mdc*, less than half as long as *ldc;* penis very long and slender, about four times as long as tegumen + uncus, with two chitinized teeth near tip; saccus very long and slender, swollen at tip, more than twice as long as tegumen + uncus; uncus long, slender, with free part long; harpé simple, rounded, with no distal process, with one spine from inner face below dorsal margin near tip.

Species examined:

* *gobrias* Hewitson

* *lycorias* Doubleday

As pointed out by Dixey ('94) and others *Dercas* is rather closely related to *Gonepteryx* and represents an offshoot from this group that has invaded the Indo-Australian region. The extraordinarily long penis is very characteristic, being exceeded in proportionate length in the Pieridae only by *Dismorphia* (*Moschoneura*) *pinthaeus.*

17. PHOEBIS Huebner ('16) p. 98, *argante* Fabricius, des. Butler ('73) I, 155

Prestonia Schaus ('20) p. 109, *argante* Fabricius, sole sp. in O. D. (as *clarki* Schaus)

Callidryas Boisduval & Leconte ('29) p. 73, *eubule* L., sole sp. in O. D.

Metura Butler ('73) p. 154, *cipris* Fabricius, des. in O. D. Homonym

Parura Kirby ('96) p. 229, *cipris* Fabricius, des. in O. D.; n. name for above

Subg. RHABDODRYAS Godman & Salvin ('89) p. 146, *trite* L., des. in O. D.

Subg. APHRISSA Butler ('73) p. 155, *statira* Cramer, des. in O. D.

Generic characters:

Medium sized to large butterflies; antenna short with gradual club; palpus with third joint short, oval; wings usually with mealy border and sex-patches in males; primary with R_1 and R_2 from cell, R_2 from before end of cell, R_3 and R_{4+5} stalked, R_{4+5} considerably longer than the distance from the end of the cell to its base, *mdc* usually slightly more than half as long as *ldc;* secondary with humeral vein very short, R_s,

M_1 and M_2 from cell separately with *mdc* the shortest of the three discocellulars, *ldc* distinctly angled; penis slender, as long as or longer than tegumen + uncus, usually gently recurved, without basal prong; saccus as long as or longer than tegumen + uncus, slender, gently curved; tegumen short with long slender articulatory process; uncus long; harpé longer than high, with a distal process, usually with an internal, rounded setiferous lobe, or if without this with a dorsal heavily chitinized spine or toothed process.

Subgeneric characters, Phoebis:

Mealy border and sex-patches of males either present or absent; dorsal margin of harpé with a dorsad projecting spine or process and inner face of harpé below this with a mesad and ventrad projecting, rounded setiferous process; setiferous "transtilla" not present.

Subgeneric characters, Rhabdodryas:

Dorsal margin of harpé without spine or process; setiferous process arising from inner face of harpé projecting dorsad above dorsal margin of harpé; setiferous "transtilla" present; mealy border present in males; secondary of male with a sex-patch near base below $Sc + R_1$, primary with no sex-patch.

Subgeneric characters, Aphrissa:

Dorsal margin of harpé with a heavily chitinized spine or a toothed process; inner margin of harpé without setiferous process; "transtilla" absent; mealy border present in males; males with a sex-patch on upper side of secondary near base below $Sc + R_1$ and one on under side of primary near base below Cu.

Species examined:

P. (*Phoebis*)
- * *agarithe* Boisduval
- * *argante* Fabricius
- * *avellanada* Herrich-Schaeffer
- * *cypris* Fabricius
- * *eubule* L.
- * *philea* L.
- * *rurina* Felder

P. (*Rhabdodryas*)
- * *trite* L.

P. (*Aphrissa*)
- * *boisduvalii* Felder
- * *godartiana* Swainson
- *jada* Butler
- * *orbis* Poey
- * *statira* Cramer

The genus has been studied in detail and the genitalia figured by both Brown ('29) and the present author ('29c). In *Phoebis* the male genitalia present excellent and stable characters for specific differentiation, more so than in any other of the *Pieridae*. Brown has, in fact, demonstrated that two species, *rurina* Felder and *intermedia* Butler can only be satisfactorily separated by the genitalia.

The specific differences shown by the genitalia are greater than those between many other genera of the Pieridae. Differences in wing shape, mealy border and sex-patches are correspondingly large. From this it is evident that *Phoebis* is a genus within which specific differentiation has proceeded very quickly, in structural characters as well as in more superficial ones. Because of this the present author is not inclined to agree with Brown in splitting off the *statira* species as a separate genus. In a group such as this where all specific differences are so great the characters for *Aphrissa* do not seem so important as they would in a group where the specific differences shown by the genitalia are almost nil.

The species here placed in *P.* (*Phoebis*) show great differences from each other, especially in the matter of the mealy border and the sex-patches. These differences are not, however, nearly as fundamental as those used for the subgeneric characters, and so it has seemed best to "lump" these species together into one rather heterogeneous subgenus.

18. KRICOGONIA Reakirt ('63) p. 355, *lyside* Godart, sole sp.

Generic characters:

Antenna short with somewhat abrupt club; palpus with third joint short, oval; male with mealy border very wide, covering practically all of wings; primary with apex sub-acute, slightly falcate; primary with R_1 and R_2 from cell, R_2 from slightly before end of cell, R_3 and R_{4+5} stalked, M_1 stalked about a third of the distance from end of cell to apex, *mdc* over half as long as *ldc;* secondary with humeral vein practically absent, R_s, M_1 and M_2 from cell separately, *mdc* shorter than *udc* and *ldc;* penis slender, strongly curved, without basal prong, less than twice as long as tegumen + uncus; saccus shorter than tegumen + uncus, thick; tegumen with long articulatory process; uncus long, thick at base, abruptly narrowing to a long, thin, gently curved free part; juxta less expanded at tip; harpé with a very complicated armature, as follows: from inner face at dorso-basal angle a long flat process with a patch of heavy setae at the end; from *outer* face a small triangular process bearing two heavy setae at end; a flat toothed process

from dorsum near tip; a simple elongate distal process; a short rounded lobe from sacculus, bearing a patch of heavy setae at its tip; a pair of very heavy setae from base of harpé on inner face about one-third way dorsad from ventral margin.

Species examined:

* *lyside* Godart (various subspecies)

Kricogonia lyside is a very peculiar insect, whose exact relationships are only to be guessed at. From the presence of a very wide mealy border and from the general structure the author considers it to be an offshoot from somewhere well back on the *Phoebis* stock. The peculiar structures on the harpé are like nothing else in the *Pieridae.* Especially noteworthy is the small dorso-basal process from the outer face of the harpé. Only here and in *Nathalis* does any structure arise from such a position.

19. LEUCIDIA Boisduval ('47) p. 77, *elvina* Godart, des. Scudder ('75) (nec *leucoma* Bates = *brephos* Huebner des. Butler ('70))

Generic characters:

Very small butterflies, primary not over 15 mm. in length; wings very thinly scaled; apex and outer margin of primary strongly rounded; antenna short, with gradual club; palpus with short oval third joint; tarsus with pulvillus but without paronychia; primary with R_1 from cell, R_2 stalked on $R_3 + R_{4+5} + M_1$, R_3 and R_{4+5} very short, M_1 stalked on $R_3 + R_{4+5}$ nearly or quite halfway from end of cell to apex, M_2 from cell with *mdc* at least half as long as *ldc;* secondary with humeral vein sometimes extending halfway to margin, R_s and M_1 stalked, M_2 from cell with *mdc* at least two-thirds as long as *ldc;* costa of secondary of male sinuate; male with a sex-patch near base of inner margin of primary beneath and another near base of costa of secondary above; penis thick, somewhat swollen at base, curved, more than twice as long as tegumen + uncus, without basal prong; saccus slender, swollen at tip, about twice as long as tegumen + uncus; tegumen short, articulatory process long; uncus slender, curved; harpé higher than long, with an obtusely pointed tip and a single long spine from inner face just above ventral margin near tip.

Species examined:

* *brephos* Huebner

* *pygmaea* Prittwitz

As in the case of *Kricogonia* the relationships of *Leucidia* are rather hard to trace. It may be an offshoot from the ancestral stem of *Eurema,* to some of the species of which the genitalia are very

similar. None of the species of *Eurema,* however, show a sex-patch development approaching that of *Leucidia.* This may, however, very well be a secondary development. In venation *Leucidia* is slightly more advanced than *Eurema,* in which genus only *amelia* Poey and the *Teriocolias* species have R_2 stalked.

20. GANDACA Moore ('06) 7: 33–35, *harina* Horsfield sole sp.

Generic characters:

Small, length of primary not over 28 mm.; wings broad, apex of primary somewhat rounded; sex-patches not present; antenna short with gradual club; palpus short with short oval third joint; primary with R_1 and R_2 from cell, R_3 and R_{4+5} stalked, R_{4+5} as long as the distance from the end of the cell to the fork of R_3 and R_{4+5}, M_1 stalked about a quarter of the distance from end of cell to apex, *mdc* at least half as long as *ldc;* secondary with humeral very thin, directed basad, extending about one-third way to the margin, *udc* and *mdc* about equal, approximately one-third as long as *ldc;* penis slender, straight, three times as long as uncus + tegumen, with no basal prong; saccus slender, more than two-and-a-half times as long as uncus + tegumen; tegumen very short, articulatory process well developed; uncus slender at base, considerably thickened dorso-ventrally to tip, projecting dorsad; harpé higher than long, with a long slender distal process, juxta very much reduced.

Species examined:

* *harina* Horsfield (various subspecies)

Moore's erection of *Gandaca,* based on relatively slight differences in wing-shape and venation from *Terias,* has been vindicated by the structures of the genitalia, which show excellent generic characters. Judging by these it seems as if *Gandaca* may have arisen from some relatively simple ancestral stock common to itself and *Eurema.*

21. EUREMA Huebner ('16) p. 96, *daira* Godart (*delia* Cramer) des. Butler ('70)

Sphaenogona Butler ('70) pp. 35, 44, *arbela* Huebner (*ectriva* Butler) des. in O. D.

Subg. TERIOCOLIAS Roeber ('10) p. 89, *atinas* Hewitson sole sp. in O. D.

Subg. ABAEIS Huebner ('16) p. 97, *nicippe* Cramer, des. Butler ('70)

Xanthidia Boisduval & Leconte ('29) p. 48, *nicippe* Cramer, des. Scudder ('75)

Subg. PYRISITIA Butler ('70) pp. 35, 44, *proterpia* Fabricius, des. and sole sp. in O. D.

Subg. MAIVA Smith & Kirby ('93) p. 96, *brigitta* f. *zoë* Hopffer (*sulphurea* Smith) des. in O. D.

Kibreeta Moore ('06) p. 36, *libythea* Fabricius, des. in O. D.

Subg. NIRMULA Moore ('06) *venata* Moore, des. in O. D.

Subg. TERIAS Swainson ('20) p. 22, *hecabe* L., des. in O. D. (*fide* Scudder '75)

Heurema Herrich-Schaeffer ('67b) p. 105, *impura* Vollenhoven, sole sp. in O. D.

General characters:

Size small, not over 28 mm. length of primary; antenna short, with gradual club; palpus with short third joint, with scaly vestiture; male sometimes with sex-patch on under side of primary, above base of inner margin; primary with 4 radials, R_1 from cell, R_2 usually from cell, R_3 and R_{4+5} stalked, M_1 stalked on $R_3 + R_{4+5}$ usually less than one-third of the distance from end of cell to apex, *mdc* variable in length; secondary with humeral vein very much reduced or absent, *udc* usually absent (R_s and M_1 stalked) or shorter than *mdc*, which is nearly always less than half as long as *ldc;* penis always longer than uncus + tegumen, usually more than twice as long, swollen at base, gently curved, without basal prong; saccus slender, somewhat swollen at tip, usually longer than uncus + tegumen, sometimes twice as long or more; tegumen short, with long articulatory process; uncus never strongly thickened at tip; juxta well-developed, although never very heavily chitinized; harpé always longer than high, always with a distal process and one or more lobes or spines in addition, sometimes with a considerable armature.

Subgeneric characters, Eurema:

Palpus not very hairy; antenna not heavily clothed basally with scales; male with no sex-patches; primary with R_1 and R_2 from cell, R_3 and R_{4+5} stalked, the free part of R_{4+5} never greatly less than the distance from the end of cell to its base, M_1 stalked about halfway from end of cell to base of free part of R_{4+5}, *mdc* long; secondary with R_s and M_1 from cell separately or stalked, *mdc* always less than half as long as *ldc;* penis slender, somewhat swollen at base, more than twice as long as tegumen + uncus; saccus slender, one-and-a-half or more times as long as tegumen + uncus; tegumen short with small articulatory process; uncus long, slender, with long free part; harpé with a distal process and two or more lobes or spines.

Subgeneric characters, Teriocolias:

Palpus strongly hairy; antenna thickly clothed with scales; primary with R_1 from cell, R_2 well stalked on $R_3 + R_{4+5} + M_1$, R_3 and R_{4+5} long stalked with free part of R_{4+5} less than two-thirds the length of the distance from end of cell to its base, M_1 stalked on $R_3 + R_{4+5}$ for a distance nearly or quite equal to length of free part of R_{4+5}, *mdc* less than half as long as *ldc;* secondary with R_s and M_1 connate from cell, *mdc* less than half as long as *ldc;* penis about one and one-half times as long as tegumen + uncus, slender, lightly curved; saccus about equal in length to tegumen + uncus; base of uncus thick, free part long, curved down, slender.

Subgeneric characters, Abaeis:

Palpus not strongly hairy; antenna not thickly clothed with scales basally; primary of male with a sex-patch beneath below base of Cu; primary with R_1 and R_2 from cell, R_3 and R_{4+5} stalked with free part of R_{4+5} as long as or very little shorter than distance from end of cell to its base, M_1 stalked for a distanc equal to about one-third of the length of R_{4+5}, *mdc* half or more than half as long as *ldc;* secondary with R_s from cell with very short *udc, mdc* less than half as long as *ldc;* penis two and one-half times as long as tegumen + uncus; saccus about twice as long as tegumen + uncus; articulatory process of tegumen large; free part of uncus little longer than basal part, slender, tapering, downcurved; harpé with simple distal process.

Subgeneric characters, Pyrisitia:

Palpus not strongly hairy; antenna not thickly clothed basally with scales; male without sex-patches; primary with R_1 and R_2 from cell, free part of R_{4+5} equal to or longer than distance from end of cell to its base, M_1 usually stalked more than halfway from end of cell to fork of R_3 and R_{4+5}, *mdc* half or more the length of *ldc;* secondary with R_s, M_1 and M_2 separately from cell; penis at least longer than uncus + tegumen; tegumen very short, articulatory process located very near its base; uncus long, often very lightly chitinized, with very short free part, sometimes turned dorsad, simple at tip; harpé with at least two dorsal and one ventral lobes, usually with a toothed distal process.

Subgeneric characters, Maiva:

Palpus not very hairy; antenna not very heavily clothed with scales; male without sex-patches; primary with R_1 and R_2 from cell, R_3 and R_{4+5} stalked with free part of R_{4+5} longer than the distance from end of cell to its base, M_1 short stalked, *mdc* more than half as long as *ldc;* secondary with R_s, M_1 and M_2 from cell separately, *udc* half the length of *mdc, mdc* about

half the length of *ldc;* penis more than three times the length of uncus + tegumen, slender, considerably swollen at base; saccus more than twice the length of the uncus + tegumen, slender; tegumen very short; uncus very short, with free part very short, tip turned dorsad and deeply bifurcate, not expanded laterad; harpé with two dorsal spines, a simple distal process and two ventral spines.

Subgeneric characters, Nirmula:

Palpus not very hairy; antenna not very heavily scaled; male with a sex-patch on under side of secondary below base of Cu; primary with R_1 and R_2 from cell, R_3 and R_{4+5} stalked with free part of R_{4+5} twice as long as distance from end of cell to its base, M_1 short-stalked, *mdc* more than half as long as *ldc;* secondary with R_s and M_1 from cell very close together or connate, *mdc* less than half as long as *ldc;* penis slender, more than three times as long as uncus + tegumen, swollen at base; saccus slender, more than twice as long as uncus + tegumen; tegumen very short, with large articulatory process; uncus short, with very short free part, tip simple and not turned dorsad; harpé with two dorsal spines, its distal process with a ventral flap, and one ventral spine.

Subgeneric characters, Terias:

Palpus not very hairy; antenna not heavily clothed with scales; male with a narrow elongate sex-patch above and below basal portion of Cu on primary under side; primary with R_1 and R_2 from cell, free part of R_{4+5} about one-and-a-half times as long as distance from end of cell to its base, M_1 stalked more than halfway from end of cell to base of free part of R_{4+5}, *mdc* more than half as long as *ldc;* secondary with *udc* very short, *mdc* less than half as long as *ldc;* penis slender, more than twice as long as uncus + tegumen, somewhat swollen at base; saccus little longer than uncus + tegumen; tegumen fairly long, with small articulatory process; uncus long, with very short free part, tip expanded laterad and more or less bifurcate, harpé with never less than two dorsal and two ventral spines in addition to distal process.

Key to Subgenera

1. Free part of uncus much shorter than basal part 2
   Free part of uncus longer than basal part 4
2. Sex-patch on under side of primary of male narrow, located both above and below basal portion of Cu ..... *Terias*
   Sex-patch an oval patch below Cu ..... *Nirmula*
   Male without sex-patch 3

3. Tip of uncus bifurcate; Ethiopian and Indo-Australian ... *Maiva*
   Tip of uncus simple; Neotropical ... *Pyrisitia*
4. Male with a sex-patch on under side of primary near base of inner margin ... *Abaeis*
   Male with no sex-patch ... 5
5. R_2 of primary stalked on R-stem ... *Teriocolias*
   R_2 of primary from cell ... *Eurema*

Species examined:

E. (*Eurema*)

daira group

* *daira* Godart
* *agave* Cramer
* *elathea* Cramer
* *jucunda* Boisduval & Leconte
* *nigrocincta* Dognin
* *palmyra* Poey
* *phiale* Cramer

boisduvaliana group

* *boisduvaliana* Felder
* *ecuadora* Hewitson
* *graduata* Butler
* *gratiosa* Doubleday & Hewitson
* *xanthochlora* Kollar

mexicana group

* mexicana Boisduval
* *salome* Felder

single species

* *adamsi* Lathy
* *albula* Cramer
* *amelia* Poey
* *deva* Doubleday
* *lucina* Poey
* *priddyi* Lathy
* *pseudomorpha* Klots
* *reticulata* Butler

E. (*Teriocolias*)

* *andina* Forbes
* *atinas* Hewitson

E. (*Pyrisitia*)

proterpia group

* *gundlachia* Poey
* *proterpia* Fabricius

nise group

* *dina* Poey
* *lisa* Boisduval & Leconte
* *nise* Cramer
* *venusta* Boisduval

messalina group

* *messalina* Fabricius
* *portoricensis* DeWitz
* *pyro* Godart

E. (*Abaeis*)

* *nicippe* Cramer

E. (*Maiva*)
* *brigitta* Cramer (& f. *zoë* Hopffer)
* *pulchella* Boisduval

E. (*Nirmula*)
* *venata* Moore

E. (*Terias*)
* *blanda* Boisduval
* *brenda* Doubleday & Hewitson
* *candida* Cramer
* *desjardinsi* Boisduval
* *floricola* Boisduval
* *hecabe* L.
* *mandarina* Orza
* *norbana* Fruehstorfer
* *sari* Horsfield
* *senegalensis* Boisduval
* *tilaha* Horsfield
* *tominia* Vollenhoeven

As in the case of *Phoebis* so in *Eurema* it is very hard to make hard and fast statements. The genus is evidently one of the most actively developing of the Pieridae. There are far greater structural differences betwen closely related species than there are between many other genera. It is obvious that for this reason the same standards cannot be applied, or else *Eurema* would be resolved into a perfect host of very small genera.

Teriocolias Roeber has therefore been brought back into *Eurema*, as well as most of the various genera erected by Moore and others. There is no reason beside a chance and superficial resemblance for thinking that *Teriocolias* is related to *Colias*. The stalking of R_2 of the primary has evidently occurred too many times for it to be regarded as a phylogenetic character of any importance. Only one of Moore's genera, *Gandaca*, appears to be worthy of full generic status.

For phylogenetic purposes a free use of subgenera and species groups seems to be sufficient. The classification here used is based largely on the male genitalia and the sex-patches. In the case of the species placed in *Pyrisitia* the author is not entirely satisfied that the grouping is a natural one.

The author has not been able to examine enough of the Old World species to feel competent to divide these into species groups. A great deal of specific differentiation has taken place here, especially in *Terias*.

The genus as it stands here is quite homogeneous. None of the subgenera possess characters essentially different from those of the others, being characterized almost entirely merely by different combinations of a limited set of characters. Further research may very possibly show that some of these subgenera are not worthy of even that rank.

Further details regarding the New World species may be found in the author's papers on the subject (Klots, '28a, '28b and '29a).

The author has not had the opportunity of examining the genitalia of *libythea* Fabricius, the genotype of *Kibreeta* Moore, so that the present placing of that genus as a synonym of *Maiva* is based largely on supposition.

22. NATHALIS Boisduval ('36) p. 589, *iole* Boisduval, sole sp.

Generic characters:

Size small, length of primary not over 19 mm.; antenna short with abrupt club; palpus with third joint long and slender; tarsus with neither pulvillus, or paronychia; primary with 3 radials, R_1 and R_2 from cell, R_3, R_4 and R_5 fused, M_1 stalked on R_{3+4+5} about a quarter to a third of the distance from end of cell to apex, *mdc* a half to two-thirds the length of *ldc;* secondary with humeral vein rudimentary or absent, R_s, M_1 and M_2 from cell separately, *udc* and *mdc* about equal in length, about a third of the length of *ldc;* male with a small oval sex-patch on upper side of secondary above base of R_s; penis long and slender, slightly swollen basally, about one-and-a-half times as long as tegumen + uncus, without basal prong; saccus about equal in length to tegumen + uncus, thick proximally; tegumen long, about two-thirds as long as uncus, with large articulatory process; uncus long, slender, tapering, with long free part; juxta very small and inconspicuous; harpé with a large forked spine, bearing many small spines, arising from outer face, a number of chitinized teeth on inner face and dorsal margin near tip, and a spinulated distal process.

Species examined:

* *iole* Boisduval

* *plauta* Doubleday & Hewitson

Nathalis is a most peculiar little genus, the relationships of which are practically impossible of definite determination. The reduction of the juxta is unique in the *Rhodocerini,* as is the considerable length of the tegumen as compared with the uncus. The shape of the penis and the excessive ornamentation of the harpé suggest *Eurema.* The type of sex-patch in the male is found in a number of other genera, of which *Colias* is one. The absence of paronychia and pulvilli on the tarsi is also suggestive of *Colias.* The general appearance of *iole* suggests *Colotis* or *Eurema,* that of *plauta* in a vague way *Colias.* The pupa is hardly *Pierine.* The author has only one example of this stage, which possesses no trace of the frontal prominence characteristic of the family.

23. ERONIA Huebner ('22) ii, *cleodora* Huebner sole sp.
Dryas Boisduval ('47b) 2: 588, *leda* Boisduval

Generic characters:

Antenna fairly long with gradual club; palpus with short oval third joint; male with no sex-patches; tarsus with pulvillus and paronychia, the latter very broad; primary with 5 radials, R_1 and R_2 from cell, R_3 R_4 and R_5 stalked, M_1 from cell connate with R-stem, *mdc* less than half as long as *ldc;* secondary with humeral long, turned distad from near its base, *mdc* shorter than *udc* and about one-third of *ldc;* penis very stout, nearly twice the length of tegumen + uncus, lightly curved, with heavy basal prong; saccus slender, enlarging distad, about as long as uncus + tegumen; tegumen long with fairly large articulatory process; uncus long, slender, tapering, free part about one-third of its ventral length; juxta very small and lightly chitinized; harpé simple, rounded, with no armature.

Species examined:

* *cleodora* Huebner
* *leda* Boisduval

24. NEPHERONIA Butler ('70) 1: 38, 53, *argia* Fabricius des. in O. D. (as *idotaea* Butler)
Leuceronia Aurivillius ('95) 16: 256, *buqueti* Boisduval, des. in O. D. (?) and Aurivillius ('98)

Generic characters:

Antenna fairly long with gradual club; palpus with short oval third joint; male with no sex-patches; tarsus with pulvillus and paronychia; primary with 5 radials, R_1 and R_2 from cell, R_3, R_4 and R_5 stalked, *mdc* more than half as long as *ldc;* secondary with humeral long, usually turned distad from near its base, *mdc* from half as long as *ldc* to nearly as long; penis very thick, little longer than tegumen + uncus, gently recurved, with no basal prong; saccus thick, about as long as tegumen; uncus tapering, free part about one-third of ventral margin; juxta small; harpé with a simple distal process but without other armature.

Species examined:

* *argia* Fabricius
* *avatar* Moore
* *pharis* Boisduval
* *thalassina* Boisduval

25. PARERONIA Bingham ('07) 2: 276, *valeria* Cramer des. in O. D.
Paphia Fabricius in part (*P. baebera* Esch. Kotzb. Reise, 3: 211, t. 6, f. 10, = *Pareronia valeria* Cr.)

Generic characters:

Antenna long with gradual club; palpus with short oval third joint; male with large sex-patch on apical and marginal area of secondary above; tarsus with both pulvillus and paronychia; primary with 5 radials, R_1 and R_2 from cell, R_3, R_4 and R_5 stalked, M_1 from cell connate with R-stem, *mdc* more than half as long as *ldc;* secondary with humeral long, turned distad very much less than in *Eronia* and *Nepheronia* and from nearer tip; R_s, M_1 and M_2 from cell separately, *mdc* nearly or as long as *ldc;* penis thick, little longer than tegumen + uncus, gently recurved, without basal prong; tegumen long with long articulatory process; uncus long, tapering, with free part about one-half of ventral margin; harpé with a simple distal process and a setiferous pad on dorsal margin; juxta well developed, strongly "dished."

Species examined:

* *pingasa* Moore
* *tritaea* Felder
* *valeria* Cramer

The three genera just taken up, *Eronia, Nepheronia* and *Pareronia,* are evidently quite closely related. They show, however, excellent and constant characters for differentiation in the male genitalia, which alone would warrant their separation. Venational differences are comparatively slight. So much variation in pattern and color occurs in *Eronia* and *Nepheronia* that these can not be taken very seriously. The pattern of *Pareronia* is, however, a good character. The species of this genus are evidently mimetic. *Pareronia* has evidently been derived from *Nepheronia; avatar* is somewhat of a transitional form between the two groups. Inasmuch as the pattern and genitalia of this species correspond very closely with *Nepheronia* it has been placed in that genus, although its venation and geographical distribution correspond more with *Pareronia.*

In the possession of five radials these three genera are evidently primitive. The very short third joint of the palpus has led the author to believe that they may conceivably represent forms closely allied to the ancestral stock from which the Rhodocerini were derived. The enlarged wing cases of the Eroniine pupa may also be adduced as evidence in favor of this contention. The Eroniine genera as they are, however, undoubtedly belong in the *Pierini.*

26. COLOTIS Huebner ('16) p. 97, *amata* Fabricius des. Scudder ('75)

Aphrodite Huebner ('16) p. 95, *evippe* L. type not previously designated? (nec *Aphrodite* Leske, N. Physiol. An. p. xv, 1775)

Idmais Boisduval ('36) p. 584, *chrysonome* Klug des. Scudder ('75)

Callosune Doubleday ('46) p. 57, *danaë* Doubleday & Hewitson des. Scudder ('75)

Anthopsyche Wallengren ('57) p. 10, *achine* Cramer des. Scudder ('75)

Subg. TERACOLUS Swainson ('32) 2: 115, *subfasciatus* Swainson sole sp.

Ptychopteryx Wallengren ('57) p. 17, *subfasciatus* Swainson (as *bohemanni* Wall.) sole sp. *nomen praeocc*

Thespia Wallengren ('58) p. 77, *subfasciatus* Swainson (as *bohemanni* Wall.) n. name for above

Subg. CALOPIERIS Aurivillius ('98) p. 415, *eulimene* Klug des. in O. D.

Subg. MADAIS Moore ('06) 7: 28, *faustus* Olivet, des. in O. D.

Generic characters:

Antenna fairly long with abrupt club; palpus with short third joint; male usually without sex-patches; tarsus with pulvillus (sometimes very small) and paronychia; primary with R_1 and R_2 from cell, R_3 and R_{4+5} stalked more than halfway from end of cell to apex, M_1 from cell connate with R-stem, or short-stalked on R-stem, *mdc* usually at least half as long as *ldc;* secondary with humeral long, bent distad, R_s from cell well basad from end, M_1 and M_2 either from cell separately or connate, or stalked, *ldc* practically always more than twice as long as *mdc;* penis very thick, strongly curved from base, always longer than tegumen + uncus, with short, heavy basal prong; saccus slender or thick, shorter than tegumen + uncus; tegumen large; uncus stout basally, tapering, with free part about one-half of ventral margin; harpé sometimes with a distal process and a rudimentary clasper, never with any other lobes or spines; juxta small, lightly chitinized.

Subgeneric characters, Colotis:

Male without sex-patches; apex of primary more rounded than in *Teracolus;* M_1 of primary sometimes stalked; *mdc* of secondary sometimes absent by stalking of M_1 and M_2; penis one and a half times as long as tegumen + uncus, or longer; harpé simple, with no distal process and no rudimentary clasper.

Subgeneric characters, Teracolus:

Male without sex-patches; apex of primary more acute than in other subgenera; M_1 of primary always connate from cell with R-stem; *mdc* of secondary never much shorter than *udc;* penis not one and a half times as long as tegumen + uncus; harpé sometimes with a rudimentary clasper, always with a sharp finely toothed distal process.

Subgeneric characters, Calopieris:

The author has not had the opportunity of examining a specimen of *Calopieris eulimene.* According to the description of the author of the genus, (Aurivillius, '98, p. 415) the most striking character is the extreme shortness of the palpus.

Subgeneric characters, Madais:

Male with an oval sex-patch on under side of primary above basal portion of 2d A; primary with M_1 connate from cell, *mdc* less than half as long as *ldc;* secondary with *mdc* about half as long as *udc;* male genitalia with no essential differences from those of *C.* (*Colotis*).

Key to Subgenera

1. Male without sex-patches 2
   Male with sex-patch on under side of primary ..... *Madais*
2. Harpé simple, without distal process 3
   Harpé with a distal process ..... *Teracolus*
3. Palpus very small and short, hardly reaching beyond front. *Calopieris*
   Palpus longer ..... *Colotis*

Species examined:

C. (*Colotis*).
- * *amatus* Fabricius.
- * *bacchus* Butler.
- *elgonensis* E. Sharpe.
- *eucharis* Fabricius.
- * *evarne* Klug.
- * *evippe* L.
- *gueni* Mabille.
- *incretus* Butler.
- * *ione* Godart.
- * *mananhari* Ward.
- * *omphale* Godart.
- * *venustus* Butler.
- *wallengreni* Butler.
- * *zoë* Grandidier.

C. (*Teracolus*).
- * *eris* Klug.
- * *subfasciatus* Swainson.

C. (*Madais*).
- * *faustus* Olivet.

Colotis presents a strange complex of species showing great variation in color, pattern and venation, without there being many tangible characters for their separation. Within the subgenus *Colotis* as here held are found some species with M_1 of the primary stalked, while others have this vein from the cell. Some species have M_1 and M_2 of the secondary stalked, while others have these veins well separated from the cell. In view of the evident close relationship of some of the species which differ from each other widely in these characters too much reliance cannot be placed upon them. The male genitalia of practically all of the species of *Colotis* which the author has examined show no tangible specific characters whatsoever. It has therefore seemed best to the author to recognize as subgenera such groups as have some reasonable excuse for existence, and to leave further splitting, if any may be required, to some future time.

In view of the great degree of homogeneity in the male genitalia of most of the species the difference of these structures in *subfasciatus* and *eris* assumes larger proportions. They may be regarded as somewhat more primitive in this respect than the other species. *Subfasciatus* even shows a trace of the vanishing clasper of the ancestral stock.

Lucasi Grandidier not only differs considerably from the *Colotis* species in size, general appearance and wing-shape but in the male genitalia, so that the author considers it worthy of being placed in a separate genus.

27. **GIDEONA** genus nov., type *Callidryas lucasi* Grandidier

Generic characters:

Size large, length of primary over 32 mm.; antenna long, with abrupt club; palpus reaching beyond front, with third joint very short, oval; male without sex-patches; apex of primary slightly falcate; primary with R_1 and R_2 from cell, R_3 and R_{4+5} long-stalked, the free part of R_{4+5} about two-thirds as long as the distance from the end of cell to its base, M_1 from cell practically connate with R-stem, *mdc* more than half as long as *ldc;* secondary with humeral extending about halfway from $Sc+R_1$ to margin, curved distad from about one-third way out, *mdc* about four-fifths as long as *udc* and about half as long as *ldc;* penis very slender, bent near middle to nearly 90°, about one and three-quarters as long as tegumen + uncus, with small basal prong; saccus slender, about two-thirds as long as tegumen; tegumen long with large articulatory process; uncus short, less than half as long as tegumen, tapering, with free

part less than half of length of ventral margin; harpé much longer than high, with a long slender pointed distal process; juxta very large and heavily chitinized, deeply dished out.

Species examined:

* *lucasi* Grandidier.

In venation *lucasi* agrees well with various species of *Colotis*. The presence of a distal process on the harpé may be merely primitive. The very short third joint of the palpus shows relationship to *Colotis* or *Eronia*. The other genitalic characters and the large size and falcate apex of the primary may be regarded as individual developments. Its exact relationships are therefore uncertain. Madagascar has a well-deserved reputation for producing queer species, and *lucasi* is one of these.

28. IXIAS Huebner ('16) p. 95, *pyrene* L. des. Butler ('70)
Thestias Boisduval ('36) p. 590, *pyrene* L. type not previously designated.

Generic characters:

Antenna fairly long, with rather gradual club; palpus with third joint short and oval; male without sex-patches; primary with R_1 and R_2 from cell, R_3 and R_{4+5} stalked with R_{4+5} more than two-thirds as long as distance from end of cell to its base, M_1 short-stalked on R_3+R_{4+5}, *mdc* not half as long as *ldc;* secondary with humeral fairly long, at about one-third bent sharply distad with a short spur projecting basad from the angle, *mdc* about equal in length to *udc* and about half as long as *ldc;* penis rather thick, about one-and-a-quarter times as long as tegumen + uncus, bent strongly from base, with a short thick basal prong; saccus slender, shorter than uncus; tegumen large with very small articulatory process; uncus shorter than tegumen, tapering, blunt, with free part about one-third of length of ventral margin; juxta small and lightly chitinized; harpé simple, rounded, with no spines or distal process;

Species examined:

* *flavipennis* Grose-Smith.
* *kuehni* Roeber.
* *pyrene* L. (various subspecies).
* *undatus* Butler.

Ixias is evidently very closely related to *Colotis,* and has probably been almost directly derived from that genus, being slightly higher in venation in having M_1 of the primary always definitely stalked. The similarity in pattern between *C. zoë* and *I. kuehni* is noteworthy.

29. EUCHEIRA Westwood ('34) p. 38–44, *socialis* Westwood, sole sp. in O. D. Not a homonym of *Eucheirus* Dejean 1833

Schatzia Kirby ('96) p. 162, new name for above (unjustified).

Generic characters:

Antenna fairly long, with abrupt club; palpus with third joint slender, nearly as long as second; both primary and secondary with discal cell long; primary with R_1 and R_2 from cell, R_3 and R_{4+5} stalked nearly halfway to apex, M_1, M_2 and M_3 from cell separately, *udc* about half as long as *mdc,* which is slightly shorter than *ldc;* secondary with humeral long, turned slightly basad, *udc* longer than *mdc* and *ldc* which are nearly equal; penis fairly thick, little longer than tegumen + uncus, strongly curved from base, with a short basal prong; saccus very short and thick, about half as long as tegumen; tegumen very large and broad, with a lightly chitinized area in center, articulatory process very small; uncus very short, pointed, with free part about one-half of ventral length; juxta small; harpé simple, rounded, with no armature, dorsal margin swollen dorsad for distal half; larvae living gregariously in a thick silken web, pupating in the web.

Species examined:

* *socialis* Westwood.

With *Eucheira* begins a series of genera, *Neophasis, Catasticta* and *Archonias* being the others, which are characterized most strikingly by an extreme development in size of the tegumen, with a correlated decrease in size of the articulatory process and an extreme shortening of the uncus, as well as other characters. The author feels that these genera are all rather closely related to each other, not merely because of the genitalic similarities, but because of corresponding likeness in venation, pattern, and to a certain degree in habits. In venation *Eucheira* is the most primitive, having all the branches of Media arising from the cell. In *Catasticta* and *Neophasia* M_1 has become stalked, and in *Archonias* R_2 has also moved distad and become stalked. It is noteworthy that the larvae of *Neophasia* show an approach to the extreme gregarious habit of those of *Eucheira.* In all of these genera the humeral vein is fairly long and slightly turned basad, and the saccus is likewise very short and thick in all.

30. NEOPHASIA Behr ('69) p. 303, *menapia* Felder sole sp. in O. D.

Generic characters:

Antenna fairly long, with flattened, abrupt club, palpus

with third joint slender, more than half as long as second; both primary and secondary with discal cell long; primary with R_1 and R_2 from cell, R_3 and R_{4+5} stalked, the free part of R_{4+5} being less than half as long as distance from end of cell to its base, M_1 stalked on R_3+R_{4+5} from a third to nearly half of the distance from end of cell to fork of R_3 and R_{4+5}, M_2 from cell with *mdc* nearly as long as *ldc;* secondary with humeral long, slightly turned basad, R_8, M_1 and M_2 from cell separately; penis very short, slender, shorter than tegumen + uncus, with large basal prong, strongly curved from base; saccus very short and thick, shorter than uncus; tegumen large with very small articulatory process; uncus short, pointed, with free part less than a third of the ventral length; juxta small, lightly chitinized; harpé simple, rounded, with no armature, its dorsal margin not noticeably swollen.

Species examined:

* *menapia* Felder.
terlootii Behr.

31. CATASTICTA Butler ('70) p. 34, 43, *nimbice* Boisduval, des. in O. D.

Generic characters:

Antenna fairly long, with flattened, abrupt club; palpus with third joint slender, more than half as long as second; both primary and secondary with discal cell long; primary with R_1 and R_2 from cell, the latter from the end, R_3 and R_{4+5} long-stalked with free part of R_{4+5} less than half as long as distance from end of cell to its base, M_1 stalked about a quarter to a third way from end of cell to fork of R_3 and R_{4+5}, *mdc* and *ldc* about equal in length, long, straight; secondary with humeral long, slightly turned basad, often forked at tip; penis considerably longer than tegumen + uncus, fairly slender, with basal prong, strongly bent from base; saccus very short and thick; tegumen large and wide, with very small articulatory process; uncus short, pointed, free part about one-third of its ventral length; a slight chitinization beneath the anus (subscaphium); juxta small; harpé rounded, with no armature, its dorsal margin considerably swollen dorsad.

Species examined:

* *corcyra* Felder.
eurygania Hewitson.
flisa Herrich-Schaeffer.
pinava Doubleday.
* *pitana* Felder.
suasa Staudinger.
* *nimbice* Boisduval.
philoscia Felder.
* *pieris* Hopffer.
teutila Doubleday.
* *uricoecheae* Felder.

32. ARCHONIAS Huebner ('25) fig. 461–462, *tereas* Huebner sole sp.

Euterpe Swainson ('32) p. 24, *tereas* Huebner sole sp.

Priamides Huebner ('16) p. 87, (*P. iulus* Huebner in Zutr. Exot. Schmett. f. 383, 384, 1923, = *Archonias tereas* Huebner).

Subg. CHARONIAS Roeber ('10) p. 68, *eurytele* Hewitson, not previously designated as genotype.

Generic characters:

Antenna long, with flattened abrupt club; palpus with third joint slender, two-thirds as long as second; primary with R_1 from cell, R_2 stalked, R_3 and R_{4+5} long-stalked, M_1 stalked beyond base of R_2, *mdc* and *ldc* nearly equal, very straight; secondary with humeral fairly long, curved basad, R_5, M_1 and M_2 from cell; penis considerably longer than tegumen + uncus, slender, considerably swollen at base, strongly curved from base, with short basal prong; saccus very short and thick; tegumen very wide, with very small articulatory process; uncus very short, pointed, with short free part; juxta small; harpé considerably swollen dorsad.

Subgeneric characters, Archonias:

Pattern simple, mimicking the *Aristolochia* group of *Papilio;* wings shorter than in *Charonias;* middle and lower discocellulars of primary usually more or less equal in length; *mdc* of secondary usually considerably shorter than *udc;* no constant genitalic differences from *Charonias.*

Subgeneric characters, Charonias:

Pattern more complex, with (usually) a row of marginal or submarginal spots, and darker streaking along veins; wings longer and narrower than in *Archonias; mdc* of primary shorter than *ldc,* sometimes only half as long; *mdc* of secondary as long as or longer than *udc.*

Species examined:

A. (*Archonias*).

* *bellona* Cramer.

* *pharnakia* Fruehstorfer.

* *tereas* Huebner (various subspecies).

A. (*Charonias*).

* *eurytele* Hewitson (various subspecies).

* *theano* Boisduval.

The characters for *Charonias* are slight, and hardly sufficient to validate its subgeneric rank, much less a generic status. The *A.* (*Archonias*) species must be regarded as a group which has diverged along the lines of mimicry of the *Aristolochia* group of

Papilio, while the *A.* (*Charonias*) species have retained more of the ancestral pattern of the group. The venational characters cited by Röber were partially incorrect, the remainder being rather inconstant.

33. APORIA Huebner ('16) p. 90, *crataegi* L. sole sp. in O. D.
Leuconea Donzel ('37) p. 80, *crataegi* L. sole sp.
Futuronerva Bryk ('28) p. 50, *absurda* Bryk sole sp.
Subg. MESAPIA Gray ('56) p. 92, *peloria* Hewitson, sole sp.
Subg. METAPORIA Butler ('70) p. 38, 51, *agathon* Gray, des. in O. D.
Betaporia Matsumura ('19), *moltrechti* Oberthür, des. in O. D. (= *agathon moltrechti*).

Generic characters:

Antenna fairly long with rather abrupt club; palpus with third joint slender, nearly or as long as second; primary with R_1 and R_2 from cell, R_3 and R_{4+5} long-stalked, M_1 stalked nearly or quite half as much, M_2 from cell with *mdc* varying from half as long as *ldc* to as long as *ldc;* secondary with humeral angle considerably expanded, humeral vein reaching from about halfway to margin to nearly reaching margin, straight, with tip usually either bent distad or forked; R_s, M_1 and M_2 from cell separately; penis fairly slender, bent strongly from base, as long as or longer than uncus + tegumen, with basal prong; saccus varying from very short and thick to slender and as long as uncus + tegumen; tegumen large, with small articulatory process; uncus short or long, considerably thickened dorsoventrally, sometimes bifurcate, with free part about half its ventral length; juxta small and lightly chitinized; harpé simple, rounded, sometimes with a rudimentary rounded distal process, with inner sac and central fovea.

Subgeneric characters, Aporia:

Size in general medium, length of primary seldom over 34 mm.; palpus hairier than in *Metaporia;* wings shorter and broader than in *Metaporia* and *Mesapia;* R_2 arising closer to end of cell than in *Metaporia mdc* and *ldc* or primary more nearly equal than in *Metaporia* and *Mesapia;* saccus very short and thick, little if any longer than uncus; uncus not greatly swollen distad of anus, never bifurcate; end of harpé more or less with a rounded point.

Subgeneric characters, Mesapia:

Small, length of primary not over 27 mm.; wings very thinly scaled; palpus very hairy; primary with R_2 arising very close to end of cell, *mdc* about half as long as *ldc;* secondary with *udc* about five times as long as *mdc* and twice as long as

ldc; genitalia not essentially differing from those of *Aporia* except that free part of uncus is considerably swollen as in *Metaporia.*

Subgeneric characters, Metaporia:

Large, length of primary usually considerably over 36 mm.; wings longer and thinner than in *Aporia;* palpus not so hairy as in *Aporia;* primary with R_2 arising further back on the cell and *mdc* considerably shorter than in *Aporia;* saccus much more slender than in *Aporia,* longer than uncus, somewhat swollen at tip; uncus considerably swollen distad of anus, then abruptly pointed, bifurcate; harpé in general with end more rounded than in *Aporia.*

Species examined:

A. (*Aporia*)
- * *crataegi* L.
- * *hippia* Bremer
- * *leechii* Moore
- * *leucodice* Eversmann

A. (*Mesapia*).
- * *peloria* Hewitson.

A. (*Metaporia*).
- * *acraea* Oberthür.
- * *agathon* Gray.
- * *delawayi* Oberthür.
- * *largeteaui* Oberthür.

At it stands *Aporia* is a very homogeneous genus. The characters for the subgenera are relatively slight, although constant.

With *Aporia* begins a series of genera, the others being *Cepora, Delias, Pereute* and *Leodonta,* which show a marked relationship to each other. In most of these the uncus is thick and often bi- or trifurcate. In all of them the harpé is very thick and contains between the two normal layers a peculiar spinulated sac. In addition there is a sort of a fovea located in the center of the harpé, usually more or less covered on the inner face by a chitinized flap. Previous authors (Dixey '94, Talbot '29a, and others) have pointed out the evident relationship of *Aporia* and *Metaporia* with *Delias* and *Cepora,* and discussed the probability of the first named genera representing ancestral forms for the latter. Such a theory is strengthened by the structures of the genitalia.

In the New World, *Pereute* and *Leodonta* show the same type of structure as possessed by *Delias.* The venation is also of very much the same type, with the exception of the humeral vein. A striking character showing the relationship of *Pereute* to *Delias* is the form of the pupa, which is practically indistinguishable from that of *Delias* (Fig. 10). It is only reasonable to suppose that

Pereute and *Leodonta* represent New World offshoots from this same *Aporiine* stock, which have become isolated in the tropics.

34. CEPORA Dalman ('20) p. 76, *nerissa* Fabricius, des. Scudder ('75)

Huphina Moore ('81) p. 136, *coronis* Cramer des. in O. D.

Generic characters:

Antenna fairly long with fairly abrupt club; palpus with third joint slender, as long as second joint and sometimes third, with long bristly hair; primary with R_1 and R_2 from cell, R_3 and R_{4+5} long-stalked, M_1 stalked on R-stem from less than a third to nearly halfway from end of cell to fork of R_3 and R_{4+5}, *mdc* from a third to over half as long as *ldc;* secondary with humeral vein fairly long, bent distad from near its base; penis as long as or longer than tegumen + uncus, bent to nearly 90° from about one-third, without basal prong; saccus shorter than tegumen, slender; tegumen long, not very wide, with small articulatory process; uncus long, slender, pointed, with a well-developed, bladelike dorsal keel, free part about one-half of ventral length; juxta medium-sized, somewhat hollowed-out ventrally; harpé with strong inner sac and central fovea, dorsal margin sometimes lightly notched, without distal process or lobes.

Species examined:

* *abnormis* Wallengren.
* *amalia* Vollenhoven.
* *aspasia* Stoll.
* *coronis* Cramer.
* *judith* Fabricius.
* *laeta* Hewitson.
* *nadina* Lucas.
* *nerissa* Fabricius.
* *perimale* Donovan.
* *phryne* Fabricius.
* *timnatha* Hewitson.

The supposed phylogenetic position of *Cepora* has already been discussed under *Aporia.* The coloring and pattern of many of the species is exceedingly similar to the types displayed by some species of *Delias,* and there seems no reason for not accepting a relationship between these genera.

Reasons for accepting Dalman's generic names and for not considering them uncharacterized have already been set forth under *Leptidia.* In the case of *Cepora vs. Huphina* it does not seem worth while to retain *Huphina.* The name has only been in use for a comparatively short time, and its loss will not cause as much confusion as would result from the loss of *Anthocharis* and *Gonepteryx.*

Aoa affinis Vollenhoven has usually been placed in *Cepora,* later authors being disinclined to accept Moore's genus for it. The

present author not only considers it a good genus but thinks that it is not at all closely related to *Cepora* for reasons which will be set forth under *Aoa*.

35. DELIAS Huebner ('16) p. 91, *egialea* Cramer, des. Butler ('70)
Symmachlos Huebner ('22) ii, *nigrina* Fabricius, sole sp.
Thyca Wallengren ('58) p. 76, *aganippe* Donovan, des. Scudder ('75)
Subg. CATHAEMIA Huebner ('16) p. 92, *caenaeus* L. des. Scudder ('75)
Piccarda Grote ('00) p. 32, *eucharis* Drury des. in O. D.

Generic characters:

Antenna long with somewhat abrupt club; palpus with third joint slender, as long as or longer than second joint; tarsus with both pulvillus and paronychia; primary with R_1 from cell, free at tip, R_2 missing, R_3 and R_{4+5} long-stalked, M_1 stalked on R_3+R_{4+5} for a quarter to a third the distance from cell to apex, *mdc* and *ldc* subequal; secondary with humeral long, bent distad from base, R_s, M_1 and M_2 from cell separately; penis never much longer than tegumen + uncus, curved from base, with short thick basal prong; saccus shorter than tegumen, often slender at base and enlarged distally; tegumen with large articulatory process; uncus long, free part swollen, often bi- or trifurcate; a slight chitinization in subscaphium; juxta small or medium-sized, hollowed-out; harpé large, thick, with large inner sac and prominent central fovea, dorsal margin often swollen dorsad, often with a distal process which may bear a patch of setae distally.

Species examined:

* *aglaia egialea* Cramer.
belisama Cramer.
* *belladonna* Fabricius.
descombesi Boisduval.
dorimene Cramer.
eucharis Drury.
* *harpalyce* Donovan.
* *hyparete* L.
* *inferna* Butler.
* *mysis* Fabricius.
* *nigrina* Fabricius.
* *pandemia* Wallengren.
* *thysbe* Cramer.

Because of lack of sufficient material for study the author feels that he is not qualified to make any further definite statements regarding *Delias*. There is no particular need of such, as the genus has been very completely monographed by Talbot ('28, '29a, '29b, '29c, '30). The classification above is that of Talbot, with minor exceptions.

(*Continued in March, 1932*)

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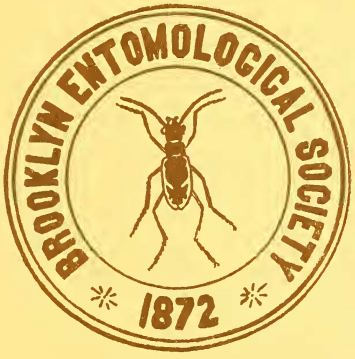

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(*Continued from page 204.*)

36. PEREUTE Herrich-Schaeffer ('67b) p. 105, *callinice* Felder des. Butler ('70)

Generic characters:

Antenna long, with somewhat abrupt club; palpus with third joint slender, nearly as long as second; tarsus with both pulvillus and paronychia; primary with R_1 from cell, its tip running along coastal and apical margin to fuse with tip of R_3, R_2 missing, R_3 and R_{4+5} long-stalked, M_1 stalked on R-stem for about a third of distance from end of cell to fork of R_3 and R_{4+5}, *mdc* and *ldc* sometimes nearly equal, or *mdc* longer than *ldc* with latter angled; secondary with humeral long, bent slightly basad, R_s, M_1 and M_2 from cell separately; penis longer than tegumen + uncus, slender, strongly recurved, with basal prong; saccus thick, shorter than tegumen; articulatory process of tegumen medium-sized; uncus thick, swollen dorso-ventrally after anus, trifurcate; considerable chitinization in subscaphium; juxta small; harpé simple, rounded, its dorsal margin somewhat swollen dorsad, with large inner sac and central fovea; pupa with forked frontal prominence, slender and bent dorsad at middle.

Species examined:

* *antodyca* Boisduval.
* *callinice* Felder.
* *charops* Boisduval.
* *cheops* Staudinger.
* *telthusa* Hewitson.

37. LEODONTA Butler ('70) pp. 34, 55, *dysoni* Doubleday, des. in O. D.

Generic characters:

Antenna long with flattened abrupt club; palpus with third joint slender, nearly as long as second; tarsus with both pul-

villus and paronychia; primary with R_1 from cell, its tip free, R_2 missing, R_3 and R_{4+5} long-stalked, M_1 stalked about a third way from end of cell to fork of R_3 and R_{4+5}, *mdc* and *ldc* about equal; secondary with humeral vein extending about two-thirds way to margin, slightly curved basad, *udc* and *mdc* subequal, about half as long as *ldc* which is strongly recurved; penis very slender, longer than tegumen + uncus, strongly recurved, with basal prong; saccus thick, shorter than tegumen + uncus; articulatory process of tegumen small; uncus thick, free part swollen dorso-ventrally, faintly trifurcate; a chitinization in subscaphium; juxta very small; harpé simple, rounded, with large inner sac and central fovea.

Species examined:

* *dysoni* Doubleday (various subspecies).

38. BELENOIS Huebner ('16) p. 92, *calypso* Drury, sole sp. in O. D.

Subg. ANAPHAEIS Huebner ('16) p. 92, *creona* Cramer, des. Scudder ('75)

Generic characters:

Antenna long with abrupt club; palpus with third joint slender, usually slightly longer than second; tarsus with pulvillus and paronychia present; primary with R_1 and R_2 from well basad of end of cell, R_3 and R_{4+5} long-stalked, M_1 stalked a third or more of the distance from end of cell to fork of R_3 and R_{4+5}, *mdc* sometimes slightly longer than *ldc,* curved or straight; secondary with humeral fairly long, curved distad from base, R_s, M_1 and M_2 from cell separately; penis about as long as tegumen + uncus, slender, straight, with very small basal prong; saccus slender, shorter than tegumen, flattened, with longitudinal mid-lateral keels; tegumen long, not very wide, with very large articulatory process; uncus about half as long as tegumen, blunt, free part about one-half of the ventral length; juxta fairly large, sometimes deeply dished or curved; harpé long with a pointed distal process, with no inner sac but with a structure much resembling the central fovea.

Species examined:

* *antsianaka* Ward
* *calypso* Drury
* *creona* Cramer
* *gidica* Godart
* *helcida* Boisduval
* *johnstoni* Crowley
* *mesentina* Cramer
* *severina* Cramer
* *solilucis* Butler
* *theuzi* Dewitz
* *thysa* Hopffer
* *zochalia* Boisduval

There are no constant characters of even subgeneric worth for the retention of *Anaphaeis.* The fact that *calypso,* the type of

Belenois, happens to be very slightly different from the other species does not make the slight venational and pattern differences shown by some of the *Anaphaeis* species any more important than they really are; and these differences are slight and not at all clean-cut.

There are, however, in the male genitalia as well as in venation and pattern, excellent differential characters for *Belenois,* and so the genus seems well worth splitting off from *Pieris,* in which many authors have placed it.

39. DIXEIA Talbot ('32) 65: 1–2, *charina* Boisd., des. in O. D.
Pinacopteryx auct.

Generic characters:

Size small, length of primary not over 30 mm.; antenna long, with abrupt club; palpus with third joint slender, as long as second; tarsus with both pulvillus and paronychia present; primary with R_1 and R_2 from cell, R_3 and R_{4+5} very long-stalked, *mdc* slightly shorter than *ldc;* secondary with humeral vein fairly long, curved distad from its base, *udc* and *mdc* usually about equal, shorter than *ldc;* penis shorter than tegumen + uncus, slender, bent to nearly 90° at middle, with very long, very narrow basal prong; saccus exceedingly short, thick, curved dorsad; tegumen long and narrow, with fair-sized articulatory process; uncus long, blunt; juxta large, shallowly dished or hollowed out; a slight chitinization in subcaphium; harpé long and narrow with a simple or bifurcate distal process.

Species examined:

* *doxo* Godart
* *pigea* Boisduval

Whereas the species of *Belenois* show a striking uniformity of structure in the genitalia, those of *Dixeia* appear to show more specific variation. The uniformity shown by the *Belenois* species also makes the generic differences shown by the *Dixeia* species more striking, and assures the validity of their generic rank.

40. PRIONERIS Wallace ('67) p. 383, *thestylis* Doubleday, des. Butler ('70)

Generic characters:

Size large; antenna long, with somewhat gradual club; palpus with third joint slender, nearly as long as second; costa of primary heavily spined; primary with R_1 and R_2 from cell, R_3 and R_{4+5} long-stalked, M_1 stalked, in some cases about one-fifth, in others one-third of the distance from end of cell to fork of R_3 and R_{4+5}, *mdc* slightly to considerably longer than *ldc;* secondary with humeral vein long, curved distad, R_s, M_1 and M_2 from cell separately; penis about as long as tegumen +

uncus, straight, with very small basal prong, with two mid-lateral rows of spines on distal third; saccus fairly thick, about as long as tegumen; tegumen long, narrow, with very large articulatory process; uncus about a quarter to half as long as tegumen, slender, blunt; juxta small, hollowed, bent caudad at middle; harpé long, with a mid-dorsal spine and a blunt distal process, with no inner sac but with a central fovea.

Species examined:

* *autothysbe* Huebner
* *clemanthe* Doubleday
* *thestylis* Doubleday

In the genitalia *Prioneris* strongly resembles *Belenois,* and may very well be closely related to this group. The harpé has a well developed central fovea, but no trace of a spinulated inner sac that the author has been able to see.

41. APPIAS Huebner ('16) p. 91, *zelmira* Cramer, des. Butler ('70)
    Subg. CATOPHAGA Huebner ('16) p. 93, *melania* Fabricius, des. Scudder ('75) as *paulina* Cr.
    Hiposcritia Geyer ('32) p. 16, *pandione* Geyer sole sp. in O. D.
    Trigonia Geyer ('37) p. 21, *nero* Fabricius, des. Scudder ('75), nomen praeocc.
    Tachyris Wallace ('67) p. 361, *nero* Fabricius, des. Scudder ('75)
    Lade de Niceville ('98) p. 153, *lalassis* Grose-Smith, des. in O. D.
    Subg. GLUTOPHRISSA Butler ('87) p. 248, *ilaire* Godart, des. in O. D. (as *poeyi* Butler)
    Subg. PHRISSURA Butler ('70) p. 37, 49, *aegis* Felder, des. in O. D. as *cynis* Hewitson and corrected to *aegis* later (71b, p. 171)

Generic characters:

Antenna long with abrupt club; palpus with third joint very slender and pointed, as long as or longer than second; tarsus with both paronychia and pulvillus; male and sometimes female with a long hair-pencil arising from intersegmental membrane caudad of eighth abdominal segment; primary with R_1 and R_2 from well back from end of cell, R_3 and R_{4+5} long-stalked, M_1 stalked from one-quarter to one-third of the distance from end of cell to fork of R_3 and R_{4+5}, *mdc* usually about half as long as *ldc;* secondary with humeral vein long, curved distad from its base, R_s, M_1 and M_2 from cell separately, *ldc* longer than *udc* or *mdc;* penis slender, longer than tegumen +

uncus, often strongly curved at base, with basal prong; saccus short, swollen, attached to a long cephalad extension of vinculum; tegumen long, narrow, with good-sized articulatory process; uncus slender, free part one-half to one-third of its ventral length; juxta medium-sized, hollowed out; harpé with a distal process, an inner subdorsal lobe, or unarmed.

Subgeneric characters, Appias:

Apex of primary long, but not extremely long and pointed; *mdc* of primary little shorter than *ldc;* penis slender, not strongly recurved at base, with a small distal process; tip of saccus somewhat upturned; uncus short, about half as long as tegumen; articulatory process of tegumen very large; harpé long, with a long, curved, sharply pointed distal process.

Subgeneric characters, Catophaga:

Apex of primary variable, sometimes very long and pointed; *mdc* of primary considerably shorter than *ldc;* penis slender, strongly recurved at base, with a long distal process; uncus well over half as long as tegumen; articulatory process of tegumen smaller; harpé long, rounded, with a subdorsal, curved, blunt inner spine at about middle; no distal process.

Subgeneric characters, Glutophrissa:

Apex of primary never very long and pointed; *mdc* of primary much shorter than *ldc;* penis long, slender, strongly recurved at base, with long basal prong; uncus more than three quarters as long as tegumen; harpé simple, rounded, with no distal process or inner lobe.

Subgeneric characters, Phrissura:

Primary with apex not at all drawn out and pointed; R_2 of primary from end of cell; secondary with *mdc* about two-thirds as long as *udc* and half as long as *ldc;* penis much as in *A.* (*Appias*); uncus considerably thickened dorso-ventrally, narrowing to an abrupt point; harpé simple as in *A.* (*Glutophrissa*).

Species examined:

A. (*Appias*)

* *zelmira* Cramer

A. (*Catophaga*)

* *cardena* Hewitson
* *celestina* Boisduval
* *lalage* Doubleday
* *leptis* Felder
* *melania* Fabricius
* *nero* Fabricius
* *pandione* Huebner
* *placidia* Stoll
* *zarinda* Boisduval

A. (*Glutophrissa*)

* *agathasia* Fruehstorfer
* *epaphia* Cramer
* *ilaire* Godart
* *lyncida* Cramer

* *hombroni* Lucas
* *phaola* Doubleday
* *rhodope* Fabricius
* *nephele* Hewitson
* *sabina* Felder

A. (*Phrissura*)
* *aegis* Felder

Many authors have attempted to split *Appias* into a number of smaller genera. Such efforts have, however, been based on minor venational differences and differences of wing shape, relatively unimportant and variable characters. The genitalia give distinct groupings, which have been followed here. However it may be decided, if it ever is, how much importance to attach to such genitalic characters, it must at least be admitted that they are more tangible and less liable to intergradation than others. The grouping together of such seemingly unrelated species as *ilaire*, *hombroni* and *rhodope* may appear unnatural, but if it is borne in mind that the appearance of most or all of the African species may have been modified in mimicry of or with *Mylothris* such a grouping seems less farfetched. At any rate the author is firmly convinced that whatever else may be done the genus *Appias* as it stands here should not be further split into other genera.

The author has not been able to examine a specimen of *lalassis* Grose-Smith, and so his placing of *Lade* under *Catophaga* is merely speculative.

In the original description of *Phrissura*, Butler designated *cynis* Hewitson as the genotype. His identification of the specimen before him was, however, incorrect, and the description was actually based on *aegis* Felder. Butler discovered this in a short time and ('71b, p. 171) published a note to this effect, changing the name of the genotype of *Phrissura* to *aegis* Felder.

Whether this proceeding is valid under the Code is a matter for some doubt. In Opinion 65 of the Commission the difficulty of laying down a general rule to cover such cases is mentioned, and it is recommended that such cases be referred to the Commission for individual decision.

In the present case there is fortunately no doubt that Butler had before him a specimen of *aegis*. His description states "abdomen of type with a tuft of hair below anal valves," a character possessed by *aegis* and not by *cynis*. Since, therefore, there can be no ambiguity of this sort, the present author has followed Butler's emendation, using *aegis* as the type of *Phrissura*. Distant later proposed the genus *Udaiana* for *cynis;* this proposal, too, has been followed.

42. UDAIANA Distant ('85) pp. 286, 300, *cynis* Hewitson, des. in O. D.

Generic characters:

Length of primary not over 30 mm.; antenna long with gradual club; palpus with third joint slender, as long as second; male without abdominal hair-pencil; primary with R_1 and R_2 from cell, R_3 and R_{4+5} long-stalked but shorter stalked than in *Appias,* M_1 stalked about one-third way from end of cell to fork of R_3 and R_{4+5}, *mdc* about half as long as *ldc, ldc* very lightly and evenly curved, never angled; secondary with humeral vein long, sharply bent distad from near its base, *mdc* slightly shorter than *udc* and about half as long as *ldc;* penis rather thick, not strongly recurved at base, with large basal prong; saccus slender; tegumen long and fairly broad; uncus long, slender, pointed, tapering; juxta large and hollowed out; harpé simple, rounded, very hairy, with no armature.

Species examined:

* *cynis* Hewitson (various subspecies)

Udaiana seems worth retention as a genus, although rather close to *Appias.* The lack of the abdominal hair-pencil is its most salient character, although the shorter stalking of R_3 and R_{4+5} and the shape of the discocellulars are important.

43. SALETARA Distant ('85) pp. 287, 316, *panda distanti* Butler

General characters:

Apex of primary very long and acuminate; male with a hair-pencil from 8th abdominal tergite and another from intersegmental membrane distad of 8th abdominal segment; antenna long with gradual club; palpus with third joint slender, pointed, longer than second; primary with R_1 and R_2 arising from cell, well basad of end, R_3 and R_{4+5} very long stalked, almost completely fused, M_1 stalked about one-sixth of distance from end of cell to apex, *mdc* about two-thirds as long as *ldc,* angled, with a short spur projecting into cell from angle, *ldc* straight; secondary with humeral vein fairly long, tapering, sharply curved distad from near base, discocellulars subequal, *mdc* very oblique; penis nearly twice as long as tegumen + uncus, slender, strongly curved from near base, with long basal prong; saccus slender, shorter than tegumen; tegumen fairly long with large articulatory process; uncus slender, strongly recurved dorsad and then caudad, with a pair of strong lateral barbs just before the tip; juxta rather small; harpé extremely long, with a slender, curved, sharp distal process.

Species examined:

* *liberia* Cramer

* *panda* Godart (various subspecies)

Saletara is an extremely distinct genus. Its affinities are evidently with *Appias* and there seems no reason for not believing that it may very well have been derived from that stock. The shape of the harpé and the distal process are similar to *A. zelmira,* which may represent more or less of an ancestral form.

44. PIERIS Schrank ('01) pp. 152, 164, *brassicae* L., des. Latreille ('10)

Ganoris Dalman ('16) pp. 61, 86, *brassicae* L., des in O. D. (*fide* Scudder ('75))

Subg. nov. **Glennia,** type *Pieris pylotis* Godart

Subg. SYNCHLOË Huebner ('18) I, p. 26, *callidice* Esper, des. Butler ('70)

Parapieris de Niceville ('97) p. 563, *callidice* Esper, des. in O. D. (as *chumbiensis* de Niceville)

Subg. PONTIA Fabricius ('07) p. 283, *daplidice* L., des. Curtis ('24) pl. 48 (*fide* Scudder ('75))

Leucochloë Roeber ('06) p. 49, *daplidice* L., type not previously designated

Pontieuchloia Verity ('29) p. 347, *chloridice* Huebner, sole sp. in O. D.

Generic characters:

Antenna long, with abrupt club; palpus with third joint slender, from nearly as long as to slightly longer than second; tarsus with both paronychia and pulvillus; R_1 and R_2 from cell, R_3 and R_{4+5} either very long-stalked with free parts of the veins nearly fused, or else completely fused, M_1 stalked on R-stem from less than a quarter to nearly a third of the distance from end of cell to apex, *mdc* oblique, from a third to more than half as long as *ldc;* secondary with humeral fairly long, its outer half or two-thirds curved strongly distad, R_s, M_1 and M_2 from cell separately, *mdc* shorter than *udc* and *ldc*, *ldc* more or less angled; penis stout, more or less curved, with basal prong; saccus thick, usually shorter than tegumen; tegumen large, with large articulatory process; uncus usually shorter than tegumen, usually considerably thickened dorso-ventrally; juxta large, its upper part nearly flat or slightly curved, its lower part deeply hollowed out caudad so as to form a conical structure, the closed apex of the cone caudad, the cone never more than twice as long as wide at its base; harpé simple, rounded, usually somewhat swollen dorsad, without armature (other than distal process of *P. brassicae*).

Subgeneric characters, Pieris:

Primary with R_3 and R_{4+5} long-stalked, not completely fused; wings longer with apex of primary more pointed than in *Glennia;* penis abruptly swollen before middle, then constricted, then slightly swollen again, tapering to a blunt point; saccus very short, not very thick; uncus rather slender, free part about one-third its ventral length; lower half of juxta forming cone; harpé with a pointed distal process.

Subgeneric characters, **Glennia,** subgenus nov.:

Wings shorter and broader than those of other members of genus; with apex of primary more rounded; R_3 and R_{4+5} long-stalked, not completely fused; penis slender, very straight; saccus slender, as long as tegumen; uncus very long, as long as tegumen, free part nearly half its ventral length; lower conical part of juxta not very deep, caudal tip of cone strongly rounded; harpé simple, dorsal margin little expanded dorsad.

Subgeneric characters, Synchloë:

Wings longer, with apex of primary more pointed than in *Glennia;* primary with R_3 and R_{4+5} long-stalked, not completely fused; penis somewhat curved, even in thickness, with large basal prong; saccus thick, shorter than tegumen; uncus with free part much less than one-third of ventral length; juxta with lower conical portion small, never very deep; harpé simple, rounded, somewhat swollen dorsad.

Subgeneric characters, Pontia:

Wings longer, with apex of primary more pointed than in *Glennia;* primary with R_3 and R_{4+5} completely fused; penis strongly curved from base, extreme basal portion strongly expanded laterally, basal prong small; saccus very short and thick; tegumen long with large articulatory process; uncus thick, free part about a third or less of ventral length; lower conical portion of juxta not very deep; harpé simple, rounded, somewhat swollen dorsad.

Species examined:

P. (*Pieris*)
- * *brassicae* L. (various subspecies)

P. (*Glennia*)
- * *pylotis* Godart

P. (*Synchloë*)
- * *beckeri* Edwards
- * *callidice* Esper (various subspecies)
- * *canidia* Sparrman
- * *manni* Mayer
- * *melete* Menetries
- * *napi* L. (various subspecies)

* *occidentalis* Reakirt
* *protodice* Boisduval
* *rapae* L. (various subspecies)
* *sisymbri* Boisduval
* *virginiensis* Edwards

P. (*Pontia*)
* *chloridice* Huebner
* *daplidice* L. (various subspecies)

Pieris is here limited to the rather closely related species listed above, instead of being used in the far more inclusive sense of many previous authors. As such it is a homogeneous group, not a conglomeration of loose ends. There seems no sense in placing *daplidice* in a separate genus because of the complete fusion of R_3 and R_{4+5}. These veins are so near to complete fusion in most of the other *pieris* species that the difference of *daplidice* is relatively slight.

Most of the species are so much alike in the male genitalia that contrasted with this mass of homogeneity the slight differences shown by *brassicae* and *pylotis* assume larger proportions than they would in a group where each species showed definite characters.

With the removal of many of the New World species to *Leptophobia, Tatochila, Itaballia, Ascia* and *Ganyra,* the range of *Pieris* is extended into South America only by *pylotis;* as might be expected in such a case *pylotis* shows somewhat aberrant characters.

Of the remaining genera many show close relationship to *Pieris,* both in venation and pattern and in the genitalia. The peculiar conical development of the lower part of the juxta is especially characteristic of *Pieris* and its related forms. This is shown very strongly by *Leptophobia, Itaballia* and *Perrhybris,* and less distinctly by *Tatochila, Phulia* and *Ascia.* It is also shown by *Nina,* but here the juxta has become very much reduced in size. The plain, rounded harpé of *Pieris* is also to a certain degree characteristic, but too much reliance must not be placed on this character. The trend of development in this group of the *Pieridae* is often toward a reduction of the primitive structures of the harpé, so that a simple harpé may have been developed independently many times.

45. LEPTOPHOBIA Butler ('70b) pp. 35, 45, *eleone* Hewitson, des. in O. D.

Generic characters:

Antenna very long, with somewhat gradual club; palpus with third joint slender, as long as or longer than second;

primary with R_1 and R_2 from cell, R_{4+5} long-stalked, M_1 stalked from about a quarter to nearly half of the distance from end of cell to apex, *mdc* usually much shorter than *ldc,* sometimes nearly as long; secondary with humeral slightly curved basad, usually with tip more or less forked, *udc* and *ldc* about equal, with *mdc* either very much shorter or about equal; penis short, bent strongly at extreme base, with long basal prong; saccus short and thick; tegumen with fairly large articulatory process; uncus long, considerably thickened dorso-ventrally, abruptly narrowing to a sharp point; juxta fair-sized, with lower part hollowed out to form a shallow cone; harpé simple, rounded, with no armature.

Species examined:

* *aripa* Boisduval
* *caesia* Lucas
* *cinerea* Hewitson
* *eleone* Hewitson
* *eleusis* Lucas
* *olympia* Felder
* *penthica* Kollar
* *philoma* Hewitson
* *pinara* Felder
* *stamnata* Lucas
* *tovaria* Felder

The species fall into two groups, those with lustrous underside of the secondary and with short *mdc* of both primary and secondary, and those with non-lustrous underside of the secondary and long *mdc.* Of the latter the author has examined only *caesia* (*tenuicornis*) and *cinerea. Olympia* appears to be somewhat transitional to these in the length of the discocellular. The author has been unable to distinguish any constant genitalic characters between these groups, and so does not consider them of subgeneric rank. *Caesia* and *cinerea* may in this way represent transitionals from the Pierine stock to the other species.

46. LEUCIACRIA Rothschild & Jordan ('05) p. 463, *acuta* Rothschild & Jordan, sole sp. in O. D.

Generic characters:

Small, length of primary not over 22 mm.; antenna long, with abrupt club; palpus with third joint very slender, about as long as second; secondary beneath with a pearly luster; primary with R_1 and R_2 from cell, R_3 and R_{4+5} very long-stalked, M_1 stalked about two-fifths of the distance from end of cell to apex, *mdc* about half as long as *ldc;* secondary with humeral angle strongly expanded, humeral vein straight, reaching about halfway to margin, slightly forked at tip, *mdc* about half as long as *udc,* which is slightly shorter than *ldc;* penis shorter than tegumen + uncus, its basal portion very strongly curved, with long basal prong; saccus very small, about one-half

as long as uncus; tegumen long, narrow, with large articulatory process; uncus long and slender, free part about half its ventral length; juxta very small; harpé very large, dorsal margin expanded from near base, with a short sharp distal process.

Species examined:

* *acuta* Rothschild & Jordan

Various authors have pointed out resemblances of *Leuciacria* to both *Leptophobia* and *Elodina*. It is possible that there is such a relationship, but this possibility is not borne out by any characters other than superficial ones. Neither the venation nor the genitalia of *Leuciacria* point out definite relationships of any sort, and it must for the present at least be regarded as a somewhat isolated genus.

47. ELODINA Felder ('65) p. 215, *egnatia* Godart, des. Butler ('70)

Parelodina Fruehstorfer ('10) p. 123, *anticyra* Fruehstorfer, type not previously designated. Nomen praeocc.

Elodinesthes Fruehstorfer ('14) p. 33, *anticyra* Fruehstorfer, type not previously designated; new name for *Parelodina*.

Metelodina Seitz ('27) p. 1108, *anticyra* Fruehstorfer, type not previously designated; new name for *Parelodina*.

Generic characters:

Size small, length of primary not over 24 mm.; antenna long with fairly abrupt club; palpus with third joint slender, little over half as long as second; secondary beneath with a pearly luster; primary with R_1 from cell, R_2 stalked on $R_{3+4+5} + M_1$ or from upper angle of cell, M_1 stalked on R_{3+4+5} about one-third of the distance from end of cell to apex, M_2 from cell connate with R-stem + M_1 or with very short *mdc*, *ldc* very long and recurved; secondary with humeral vein long, nearly reaching margin, straight, sometimes slightly forked at tip, *udc* very short, *mdc* short, about one-third the length of *ldc* which is strongly curved; penis slender, swollen basally, nearly twice as long as tegumen + uncus, without basal prong; saccus slender, longer than tegumen; tegumen with fair-sized articulatory process; uncus short, thick, with a pair of dorsad-extending processes at base; juxta very small; harpé simple, rounded, with no armature.

Species examined:

* *angulipennis* Lucas
* *egnatia* Godart
* *hypatia* Felder
* *walkeri* Butler

Like *Leuciacria, Elodina* has been thought to be related to *Leptophobia,* and a very close relationship to *Leuciacria* has been postulated, largely because of the pearly luster of the secondaries beneath. In every way *Elodina* is a distinct genus with no near relatives. Its relationships are very doubtful because of the great amount of development that has taken place. In venation it is very highly developed, with R_2 and M_1 both stalked, R_3 and R_{4+5} completely fused, and M_2 from the upper angle of the cell. Genitalically considerable reduction has taken place. The author prefers not to even guess at *Elodina's* ancestry and immediate relationships.

Elodinesthes Fruehstorfer is based on a very minor venational character, the fact that in some of the species R_2 arises from the upper angle of the cell instead of being stalked. The author has not been able to examine any of the species that show this character, and so his placing of *Elodinesthes* as a synonym is merely tentative.

48. TATOCHILA Butler ('70) pp. 38, 51, *autodice* Huebner, des. in O. D.
Tatocheila Scudder ('75) p. 276, *autodice* Huebner, des. in O. D.

Generic characters:

Body very hairy; primary with rather acuminate apex; antenna long, with flattened abrupt club; palpus with slender pointed third joint, about as long as second; primary with R_1 and R_2 from cell, R_3 and R_{4+5} long-stalked, the free part of R_{4+5} about one-quarter of the distance from end of cell to apex, sometimes nearly a third, M_1 short-stalked, *mdc* from one-half to one-third as long as *ldc,* secondary with humeral vein reaching about halfway to margin, straight, tapering, *mdc* about half as long as *udc* and a quarter as long as *ldc;* penis short, thick, bent basally, with basal prong, its distal portion flattened and expanded dorso-ventrally; saccus short and stout, shorter than tegumen; tegumen long and narrow, with large articulatory process; uncus fairly long and thick, free part about one-third of its ventral length; juxta very large and heavily chitinized, its upper two-thirds deeply hollowed out, its lower third smaller and more or less conical as in *Pieris;* harpé with a rounded or pointed distal process, otherwise unarmed.

Species examined:

* *autodice* Huebner
* *menacte* Boisduval
* *theodice* Boisduval
volxemi Capronnier
* *xanthodice* Lucas

Tatochila is most probably derived from *Pieris* or from stock closely related to *Pieris,* and may be regarded as the South American representative of the *Synchloë* (*callidice*) group of species. *Menacte* has heretofore been placed in *Pieris.* In every way, however, it belongs to *Tatochila.*

49. BALTIA Moore ('78) p. 288, *shawii* Bates, des. in O. D.

Generic characters:

Small, length of primary not over 22 mm.; antenna fairly long with abrupt club; palpus with third joint slender, shorter than second; palpus, body and wings very hairy; tarsus without pulvillus and paronychia; primary with R_1 and R_2 from cell, R_3 and R_{4+5} very long-stalked, M_1 stalked nearly halfway to apex, M_2 short-stalkd, *ldc* evenly curved; secondary with humeral angle considerably expanded, humeral vein long, bent distad near tip, *mdc* about one-third the length of *udc, ldc* slightly shorter than *udc;* penis short, rather straight, with small basal prong; saccus short, fairly thick, about two-thirds the length of tegumen; tegumen large with large articulatory process; uncus short, thick, free part about two-fifths of its ventral length; juxta very small; harpé simple, unarmed, broadly rounded, higher than long.

Species examined:

* *butleri* Moore
* *shawii* Bates

Baltia probably represents a group, originally derived from *Synchloë* or some closely related stock, that has become considerably modified, both in venation and genitalia. Many of its modifications can be traced to the effect of living at high altitudes. Similar developments are found in *Phulia, Piercolias, Teriocolias,* etc.

50. PIERCOLIAS Grote ('03) p. 139, *huanaco* Staudinger, des. in O. D. and sole sp.
Trifurcula Staudinger ('94) p. 56, taf. 1, figs. 7, 16, 18, *huanaco* Staudinger, sole sp. in O. D. *nomen praeocc.* (nec *Trifurcula* Zeller 1848)
Andina Roeber ('10) p. 97, *huanaco* Staudinger sole sp. in O. D.

Generic characters:

Very hairy; antenna long, with abrupt club; apex of primary sharp, outer margin convex; primary with R_1 from well basad on cell, R_2 from upper angle of cell, R_3 and R_{4+5} very long-stalked, M_1 stalked about halfway to apex, M_2 from upper angle of cell, *ldc* long, evenly curved; secondary with humeral angle very strongly produced, humeral vein long, bent basad, *mdc* shorter than *udc* or *ldc*.

The author has not had the opportunity of examining the genitalia of *P. huanaco*. It is evidently closely related to *Phulia*, but in venation somewhat more primitive. If it be postulated that *Piercolias* and *Phulia* represent a group of species descended from the *Synchloë callidice* stock of *Pieris* then *Phulia* with its greatly reduced venation must be at the top of this line of development, with *Piercolias* representing an intermediate stage.

The author has not had the opportunity of determining whether *Piercolias* lacks both pulvillus and paronychia on the tarsus as does *Phulia*. In this respect it is worth noticing that *Baltia*, the Old World Alpine derivative from the *Synchloë* stock, also lacks these structures. Whether there is a real relationship between *Baltia* and *Phulia* or whether the resemblances are merely to be regarded as similar developments, in the same type of environment is a matter of doubt. It is noteworthy in this connection that *Colias*, an Arctic-Alpine genus of the Rhodocerini, also lacks pulvillus and paronychia. The other Rhodocerine genus that lacks these is, however, *Nathalis*, which is not Alpine by any means.

Tatochila, which must be regarded as a still more primitive South American derivative from the *Synchloë* stock, and which may be on the direct ancestral line of *Piercolias* and *Phulia*, possesses both the pulvillus and the paronychia, although somewhat reduced in size. *Tatochila* is by no means, however, an Alpine genus.

51. PHULIA Herrich-Schaeffer ('67) p. 17, *nymphula* Blanchard, sole sp. in O. D.

Generic characters:

Small, length of primary not over 21 mm.; antenna long with very abrupt club; palpus with slender short third joint; body, wings and palpi very hairy; tarsus without pulvillus and paronychia; primary with R_1 and R_2 from well basad of end of cell, R_3 and R_{4+5} completely fused, M_1 stalked nearly or quite two-thirds way to apex, M_2 short stalked, *ldc* long, angled at middle; secondary with humeral angle strongly expanded, humeral vein long, curved slightly basad, *mdc* about two-fifths

as long as *udc* and *ldc* which are subequal; penis shorter than tegumen + uncus, curved basally, with long basal prong; saccus very thick, shorter than tegumen; tegumen long, with large articulatory process; uncus long, thick, free part less than half its ventral length; juxta large, hollowed out; harpé with a short, pointed distal process, otherwise unarmed.

Species examined:

* *nymphula* Blanchard

52. LEPTOSIA Huebner ('18) I, p. 13, type *xiphia* Fabr., des. Scudder ('75) (as *chlorographa* Huebner)

Nina Horsfield ('29) p. 140, *xiphia* Fabricius, sole sp. in O. D.

Nychitona Butler ('70) pp. 34, 41, *alcesta* Cramer des. in O. D.

Generic characters:

Primary with apex and outer margin very strongly rounded; antenna fairly long, with long, gradual club; palpus short, with second and third joints short, the third considerably shorter than the second; primary with R_1 and R_2 from cell, R_3 and R_{4+5} completely fused, M_1 stalked from a third to about two-fifths way to apex, M_2 from cell with very short *mdc*, or connate with R-stem + M_1, or very shortly stalked, *ldc* long, curved; secondary with humeral vein short, strongly curved distad, M_1 and M_2 connate from cell, or *mdc* very short; penis long, slender, nearly straight, with short basal prong located well distad from base; saccus shorter than tegumen, thin proximally, swollen distally; tegumen long, with very large articulatory process; uncus short, thick, free part about half its ventral length; a slight chitinization in subscaphium; juxta very small; harpé long, rounded, with no armature, a very heavy chitinization in membrane proximad and ventrad of its dorso-basal angle.

Species examined:

* *alcesta* Cramer (various subspecies)
* *immaculata* Aurivillius
* *medusa* Cramer
* *nupta* Butler
* *xiphia* Fabricius (various subspecies)

Leptosia has probably been derived from some far-back *Pierine* stock. In none of its characters does it show any close relationship to any other modern *Pieridae*, but stands alone. Genitalically it has reached a high point of reduction. In venation, likewise, it shows a high degree of specialization, only three branches of Radius

being present, and M_1 and M_2 having moved far costad and distad of their primitive positions.

53. ITABALLIA Kaye ('04) p. 204, *pandosia* Hewitson, des. in O. D.

Subgenus nov. **Pieriballia**, type *Pieris mandela* Felder

Generic characters:

Apex of primary rounded; antenna very long, with very slightly thickened, gradual club; palpus with third joint slender and pointed, much longer than second; fore metatarsus longer than fore tibia; tarsus with both pulvillus and paronychia; primary with R_1 and R_2 from cell, R_1 running very close to Sc, R_3 and R_{4+5} very long-stalked, M_1 stalked from a quarter to nearly a third of the distance from end of cell to apex, *mdc* half or more than half as long as *ldc;* secondary with humeral vein long, bent sharply distad from its base, *mdc* shorter than either *udc* or *ldc, udc* shorter than *ldc;* penis shorter than tegumen + uncus, quite straight, somewhat enlarged at base; saccus never much longer than tegumen; tegumen with good-sized articulatory process; uncus very long and very slender, pointed, free part at least three-quarters of its length; juxta with upper part little hollowed out, lower part forming a deep, narrow cone; harpé simple, rounded, with no distal process or lobes.

Subgeneric characters, Itaballia:

Outer margin of primary more convex than in *Pieriballia;* third joint of palpus more slender than in *Pieriballia;* dark marginal border of primary of male sending a spur into disc of wing below tip of M_3, which may meet with dark markings along costa to form a band across wing; penis with rudimentary basal prong, if any; saccus slender, as long as tegumen; lower, conical or tubular part of juxta twice as long as wide; inner face of ventral portion of harpé without chitinized corrugations.

Subgeneric characters, **Pieriballia**:

Outer margin of primary straighter than in *Itaballia;* third joint of palpus thicker than in *Itaballia;* dark marginal border of primary of male not sending a deep spur into disc of wing; penis with large basal prong; saccus shorter than tegumen, thick; lower, conical or tubular part of juxta shallow, little if any longer than wide; inner face of ventral portion of harpé with many chitinized corrugations.

Species examined:

I. (*Itaballia*)

* *demophile* L. (various subspecies)

* *pandosia* Hewitson

* *pisonis* Hewitson

I. (*Pieriballia*)

* *mandela* Felder (various subspecies)

* *viardi* Boisduval

In every way, pattern of both males and females, wing shape, venation, palpus, antenna, front leg and male genitalia, the species here placed in *Pieriballia* show a much closer relationship to *Itaballia* than to *Pieris*. They differ from *Itaballia,* however, in many important details, so that the author has considered it best to erect a new subgenus for them.

The genus *Itaballia* is evidently a Neotropical derivative of the *Pieris* stock. The exceedingly long, thin uncus is its most characteristic feature. This form of uncus is not possessed by *Perrhybris,* which is evidently closely related to *Itaballia,* although having a more highly specialized venation. *Itaballia* cannot therefore be placed as directly ancestral to *Perrhybris,* but must be considered as an offshoot from the line leading to the latter genus.

54. PERRHYBRIS Huebner ('16) p. 91, *pyrrha* Fabricius, des. Scudder ('75)

Generic characters:

Apex of primary rounded; antenna very long, with very slightly thickened, gradual club; palpus with third joint slender, much longer than second; foreleg with metatarsus shorter than tibia; primary with R_1 and R_2 from cell, R_3 and R_{4+5} completely fused, M_1 stalked from a quarter to a third of the distance from end of cell to apex, *mdc* about half as long as *ldc;* secondary with humeral vein long, tapering, bent sharply distad from its base, *udc* and *mdc* usually about equal, half or slightly more as long as *ldc;* penis short, stout, straight with large basal prong; saccus never longer than tegumen, thick; tegumen with fair-sized articulatory process; uncus thick at base, tapering, free part about one-half its ventral length; juxta good-sized, upper part flattened, conical lower part large, not deep; harpé ending in a rounded point, with a small setiferous pad in region of sacculus.

Species examined:

* *lorena* Hewitson

* *lypera* Kollar

* *pyrrha* Fabricius (various subspecies)

As stated under *Itaballia, Perrhybris* represents a relatively high development from an original *Pieris* stock. The females show the same highly-colored and heavy pattern as those of *Itaballia*. Possibly this is mimetic.

55. AOA de Niceville ('98) p. 153, *affinis* Vollenhoven, des. in O. D.

Generic characters:

Antenna long, with slightly thickened, gradual club; palpus with third joint slender, as long as second, bearing no long hairs; primary with R_1 and R_2 from well basad of end of cell, R_3 and R_{4+5} stalked about two-thirds of the distance from end of cell to apex, M_1 stalked about one-third of the distance from end of cell to fork of R_3 and R_{4+5}, *mdc* curved, about half as long as *ldc* which is slightly angled; secondary with humeral vein long, curved distad from about one-third its length, *udc* and *ldc* about equal and longer than *mdc;* penis considerably longer than tegumen + uncus, very thin, with long basal prong; saccus shorter than tegumen, thin proximad, swollen distad; tegumen large and broad, with large articulatory process; uncus thick at base, tapering regularly to a sharp point, with no dorsal keel, its free part about one-third its ventral length; juxta very small; harpé simple, rounded, with no armature, inner sac or central fovea.

Species examined:

* *affinis* Vollenhoven

As stated under *Cepora, Aoa* appears to the writer to have little or no connection with that genus, in which it has previously been classified. Its exact relationships are, however, very obscure. Perhaps a thorough knowledge of the life-history will help.

56. ASCIA Scopoli ('77) p. 434, *monuste* L., des. Scudder ('72)
Mancipium Huebner ('18) L., pl. [135–147], *monuste* L., des. Hemming, Entomologist, 64: 272, 1931
Subg. GANYRA Dalman ('20) p. 76, *amaryllis* Fabricius, des. Scudder ('75)

Generic characters:

Size medium to large, length of primary normally over 26 mm.; wings with or without sex-scaling; antenna long, with usually somewhat abrupt club; palpus with third joint slender and pointed, longer than second; primary with R_1 and R_2 from cell, well basad of end, R_3 and R_{4+5} very long-stalked, the free parts of these veins very short, M_1 stalked about a quarter of the distance from end of cell to apex, *mdc* straight, half or less as long as *ldc;* secondary with humeral fairly long, bent sharply

distad from its base, *udc* and *mdc* shorter than *ldc;* penis about as long as or slightly longer than tegumen + uncus, slender, somewhat swollen at base, with long slender basal prong; saccus shorter than uncus; tegumen long and quite narrow, with large articulatory process; uncus stout, its free part about one-half its ventral length; juxta large, hollowed out, its lower part not forming a conspicuous cone; harpé long, with a distal process.

Subgeneric characters, Ascia:

Club of antenna quite abrupt; wings of male without sex-scaling; *mdc* of secondary not much shorter than *udc;* juxta larger, more deeply hollowed out than in *Ganyra;* harpé with a short dorsal tooth near tip, and a distal process composed of a group of strong setae.

Subgeneric characters, Ganyra:

Club of antenna more gradual than in *A.* (*Ascia*); male with sex-scaling on wings above along veins; *mdc* of secondary much shorter than *udc;* harpé with no dorsal tooth; distal process simple, short, pointed.

Species examined:

A. (*Ascia*)

* *monuste* L. (various subspecies)

A. (*Ganyra*)

* *amaryllis* Fabricius

* *buniae* Huebner (various subspecies)

* *sevata* Felder

As pointed out by various authors *Ascia* is well worth generic differentiation from *Pieris.* This is, however, no reason for using the term "*Asciidae*" instead of "*Pieridae.*" There is no strict rule of priority in family names, and such a proceeding would only cause great confusion without serving any worth-while end.

The species here included in *Ganyra* are evidently more closely related to *Ascia* than to anything else. They also show many points of similarity to the African *Belenois.* The author's reasons for accepting Dalman's names have already been set forth under *Leptidia.*

57. MELETE Swainson ('32) p. 79, *lycimnia* Cramer, sole sp. in O. D.

Daptonoura Butler ('70) pp. 37, 50, *lycimnia* Cramer, des. in O. D. (as *flippantha* Fabricius)

Generic characters:

Outer margin of primary slightly concave; antenna long, with gradual club; palpus with third joint slender, much

longer than second; primary with R_1 and R_2 from cell, the latter well basad of end, R_3 and R_{4+5} stalked, the free part of R_{4+5} being about one-third as long as distance from end of cell to its base, M_1 stalked for a distance from cell about equal to length of R_{4+5}, *mdc* about equal to or longer than *ldc;* secondary with humeral vein reaching about halfway to margin, straight, discocellulars subequal; penis longer than uncus + tegumen, rather straight, thin, somewhat swollen at base, with short basal prong; saccus thin and very short, shorter than uncus; tegumen with fair-sized articulatory process; uncus about half as long as tegumen, with a pair of basal, dorsad-projecting, spiny processes, its free part about one-half its ventral length; juxta very small and lightly chitinized; harpé with a large toothed process on dorsum and a long curved distal process.

Species examined:

* *isandra* Boisduval
* *leucanthe* Felder
* *lycimnia* Felder (various subspecies)
* *peruviana* Lucas

Melete is a very distinct genus. The peculiar form of the harpé is characteristic of all the species which the author has examined, and cannot be confused with any similar structure in other groups. The genitalia appear to show specific differences.

Idiotica Butler, for which Butler erected the genus *Heliochroma*, has been placed in *Melete* by some authors, mainly on account of a superficial resemblance. It does not belong in *Melete* or anywhere near it, but is a *Hesperocharis,* without a doubt.

The exact relationships of *Melete* are vague. Because of the form of the male genitalia the author considers it to be descended from some stock related to *Ascia,* but the matter is open to question.

58. MYLOTHRIS Huebner ('16) p. 90, *poppea* Cramer, des. Butler ('70) p. 42
? Subg. PSEUDOMYLOTHRIS Neustetter ('29) p. 191, *leonora* Kruger, sole sp. in O. D.

Generic characters:

Apex of primary sometimes rather rounded; antenna fairly long, with abrupt club; palpus with third joint very slender, longer than second; primary with R_1 and R_2 from cell, R_3 and R_{4+5} entirely fused, M_1 stalked about one-third or more of the distance from end of cell to apex, *mdc* half to two-thirds as long

as *ldc;* secondary with humeral vein fairly long, curved distad from its base, *udc* and *mdc* subequal, shorter than *ldc;* penis longer than tegumen + uncus, stout, sharply bent at about its middle, with a very small basal prong; saccus thick, shorter than tegumen; tegumen very long and very narrow, with a very large articulatory process; uncus very short, pointed, its free part about two-thirds of its ventral length; juxta fairly large, well chitinized, rather flat; harpé rounded, somewhat expanded dorsally, with a short distal process, inner face with a rounded, lobed structure which seems to originate dorsally and is attached for most of its distal edge to inner face of harpé.

Species examined:

* *agathina* Cramer
* *chloris* Fabricius
* *dimidiata* Aurivillius
* *phileris* Boisduval
* *rubricosta* Mabille
* *smithi* Mabille

Mylothris is placed here at the end of the *Pieridae* largely because of the high degree of development shown in the venation, and because of the similarly high developments of the genitalia. These are not as great as in some of the *Rhodocerini,* but taken all in all are probably greater than in any other *Pierini.* The author is not inclined to consider the inner structure on the harpé as homologous to the clasper. If such were the case *Mylothris* would be very primitive in the retention of this structure.

The author has not had the opportunity of examining a specimen of *leonora* Kruger, the type of Neustetter's genus *Pseudomylothris.* The characters cited by Neustetter do not seem great enough to place this as a full genus, and so it has been placed tentatively as a queried subgenus.

SUMMARY AND ACKNOWLEDGMENTS

The present paper can be by no means regarded as a finished product. There is still a very great deal to be discovered about the Pieridae before our knowledge of the family can be considered as in any way complete. For this reason the writer has not stressed speculations about the phylogeny of the genera, preferring to leave such to a time when more is known about the early stages and such structures of probable taxonomic value as the scent-scales and body sclerites.

From the data on hand certain relationships may, however, be postulated. These have been shown in two "family trees," (Figs. 99 and 100), in which are the conclusions reached by the author regarding the probable relationships of many of the genera.

The relationships of the three subfamilies are somewhat in doubt. In the structure of the genitalia, as already stated under *Pseudopontia,* the Dismorphiinae are very similar to *Pseudopontia,* as regards the fusion of the harpés and the reduction and bifurcation of the tegumen and uncus. *Pseudopontia* has a unique type of venation, but one which does not show any Dismorphiine characteristics. Therefore it has seemed best to place the probable point of origin of *Pseudopontia* very low on the Dismorphiine stem. If it should be considered, however, that the resemblance in the genitalia of *Pseudopontia* and the Dismorphiinae is accidental, this point of origin would have to be from the lower part of the Pierine stem, remote from that of the Dismorphiinae.

The Dismorphiinae form a compact group, with all the genera closely related to one another. There can be no doubt that *Leptidia* belongs here, as the sole Old World representative of the subfamily. In the New World too little is known about the forms to allow of speculation about the phylogeny. Most of the species of *Dismorphia* are probably mimetic, so that it might be considered that the non-mimetic species are therefore closer to the ancestral type. Nothing is known about the life-histories of the New World species.

In the Pierinae the divisions into tribes are obvious. The Euchloini have here been separated because of the possession of a clasper, a structure which may safely be regarded as primitive. This has been lost in the other genera. The Rhodocerini are characterized by a considerable number of rather intangible characters, such as those cited in the key to tribes of the Pierinae. The change of food-plant of the Rhodocerinae genera to Leguminosae is also noteworthy.

Whether the author's limitation of the Euchloini is justified is largely a matter of opinion. Both *Hebomoia* and *Pinacopteryx* have little in common with the other genera other than the possession of a clasper. *Eroessa* is evidently closely related to the true "orange tips," and probably represents an ancestral form. In venation it is exceedingly primitive. *Hesperocharis* is also rather evidently related to the "orange tips," having a more specialized venation. *Colotis* and *Ixias* have been placed as direct derivatives of the Euchloini. Some of the more primitive species of *Colotis*

still possess a rudiment of the clasper. The relationship between *Colotis* and *Ixias* is evident. The only real difference between the two genera is the relatively slightly more specialized venation of *Ixias*. The extraordinary similarity of *Colotis zoë* and *Ixias kuehni* is noteworthy.

Gideona is probably to be regarded as an offshoot from *Colotis*. It is possible, however, that it may belong with the Eroniine genera. The structure of the pupa would be of great help in determining its relationship.

The three Eroniine genera must be placed in the Pierini, where they occupy a very primitive position. They probably represent something like ancestral forms of the Rhodocerini, as stated in the text, because of the very short third joint of the palpus, the swollen wing-cases of the pupa, and other characters.

The phylogeny of the Rhodocerini is extremely involved by the great amount of specialization that has taken place in some of the genera. As stated under *Colias* (*q.v.*) this genus, *Anteos* and *Catopsilia* appear to represent one line of development in the genitalia, while the other genera are on another line. It is possible that this is not a natural grouping. The relationships of the other genera are very obscure. *Kricogonia* is possibly related to *Phoebis*. *Gonepteryx* and *Dercas* show considerable similarity, and it is probable that the latter is a tropical derivative of the former, which is practically limited to the Palearctic region. *Nathalis* is very peculiar, and almost certainly represents an independent line of variation, as *Leucidia* possibly does also. Within *Eurema* a great deal of specialization has taken place. As previously stated under that genus the author does not, however, consider any of the subgenera included in *Eurema* as worthy of generic rank.

As already stated the Eroniae must be regarded as primitive Pierini. *Colotis* and *Ixias* are also included in this tribe, in spite of their evident Euchloine derivation.

Eucheira, Neophasia, Catasticta and *Archonias* all show great similarity of structure in the genitalia, and probably represent a distinct line of development. *Eucheira* is the most primitive member of the group, and may represent more or less of an ancestral form to the others. The social habit of the *Eucheira* larvae is also possessed, though to a lesser degree, by *Neophasia*. *Archonias* has probably developed along the line of mimicry of the *Aristolochia* Papilios, while *Charonias* has retained the ancestral streaked pattern or mimics *Ithomiidae*.

Aporia, Cepora, Delias, Pereute and *Leodonta* probably represent another distinct line of development. The three latter genera are highly specialized in venation, possessing only three radials. It is possible that the resemblance of *Pereute* and *Leodonta* to *Delias* is merely accidental. The fact of their isolation in the New World tropics, with no geographical connecting links to *Delias* or *Aporia* is an argument in favor of a theory of their independent origin. The author considers, however, that their similarity to *Delias* is too great, and in too many structures, to be purely fortuitous.

Belenois and *Prioneris* are evidently related to each other, and are very possibly related to the *Aporia-Delias* line, as evidenced by their possession of a fovea in the harpé. In pattern, however, there is considerable evidence that *Belenois* is closely related to the *Synchloë* group of *Pieris*, and such may be the case. The *Belenois* pupa is more like that of *Pieris* than that of *Delias.*

The species of *Dixeia* show evidences of having been derived from either *Belenois* or *Pieris,* more probably the former. The structures of the genitalia are of a type that can easily have been formed from those of *Belenois.*

There is no valid reason for splitting the species here included in *Appias* into a greater number of genera as has been done in the past. *Saletara* is very distinct and well worthy of generic rank, having been evidently derived from *Appias.* The exact origin of *Appias* is uncertain. At present all that can safely be said is that it has probably been derived from the generalized Pierine stock fairly well back, as shown in Fig. 100.

Pieris is here limited to a definitely related group of subgenera instead of being used, as has been done in the past, as a term for any Pierid with 4 radials that did not evidently belong in one of a short list of other, early-recognized genera. The genitalia are very simple, a condition evidently arrived at by reduction. No highly specialized and striking structures are present. The venation is in general at the point where R_4 and R_5 are about to fuse completely, and this has happened in *P.* (*Pontia*), producing a three-radialed condition. *Pieris* may therefore be said to be on the direct line of simplification from the ancestral form of the family, showing no distinct sidewise specializations with the possible exception of the form of the juxta.

Leptophobia is evidently closely related to *Pieris,* and probably represents a derivative of some form of that genus in the Neo-

tropical region. Whether there is any real relationship between *Leptophobia, Leuciacria* and *Elodina* is a matter for much doubt. It is probable that the resemblances between these genera are merely fortuitous, and that the two latter represent independent lines of development.

Baltia in the Old World and *Tatochila, Phulia* and *Piercolias* in the New World probably are derivatives from *P.* (*Synchloë*) or some closely related ancestral stock of that group, more or less specialized for an Alpine existence. The close similarity of *Baltia* to the other three genera cited may indicate a real relationship, or may result merely from more or less parallel development from a common ancestor. The latter case is the more likely.

Leptosia appears to have no close relatives. It probably represents a derivative of a stock that split off far back on the Pierine line of development.

Itaballia represents another independent line of development from the general Pierine stock. In many ways the group shows closest relationships to *Pieris*, with *I.* (*Pieriballia*) representing somewhat of a transitional form from this genus to the species of *I.* (*Itaballia*). *Perrhybris* is much more highly specialized in venation than *Itaballia*, having only 3 radials, and would appear in pattern and wing-shape to be an *Itaballia* derivative. The genitalia of *Perrhybris* show, however, none of the peculiar characteristics of those of *Itaballia*, so that it must be supposed that the connection of *Itaballia* and *Perrhybris* was at a point subsequent to the derivation of the pattern and wing-shape and previous to the development of the *Itaballia* genitalia.

Aoa has long been classified with *Cepora* (*Huphina*). The author has already stated his reasons for considering it not only unrelated to this latter genus but on an independent line of development.

Ascia, as has been a number of times demonstrated, is undoubtedly generically distinct from *Pieris*. It is probably, however, a derivative of this genus, or of one of its immediate ancestral forms. The Neotropical species best characterized by the presence of sex-scaling along the veins of the males are here considered worthy of subgeneric rank. Their relationship is evidently with *Ascia*. The genitalia are in many ways rather similar to those structures in *Belenois*, and it is conceivable that some slight connection exists between these two groups.

Melete is a genus of rather uncertain relationships. The resemblance of one or two of the species to *Appias* can only be considered

as accidental; it is probable that it is a derivative from some ancestral form of *Ascia*.

Mylothris undoubtedly represents an independent line of development. In venation it is highly specialized, possessing but three radials. If the structure in the middle of the harpé is a true clasper, then in this respect *Mylothris* must be regarded as primitive; if, on the other hand this is an independently derived structure it shows a high degree of specialization and one without parallel in the Pierini. This structure is fused with the harpé along its distal margin and is more or less sac-like and lobed, characteristics very unlike any form of clasper known to the author.

In any work such as the present, errors are bound to creep in. The author has not been able to examine nearly as many species in many genera as he would like to have, and for this reason some of the taxonomic characters cited may prove unreliable. Likewise he has not been able to examine the original publication of many of the generic descriptions, and has therefore been forced to rely to some extent on the bibliographies and citations of other authors, some of which may contain errors. For any omissions and lapses of his own which may occur no excuses can be offered.

Perhaps the author has attached too much importance to the characters afforded by the genitalia. That will be for future workers, with more complete knowledge and better facilities, to decide. However this may be, he hopes that he has sufficiently demonstrated that these structures do offer important characters, which competent workers cannot afford to ignore as has been done in the past.

Application of the present International Code of Zoological Nomenclature has, of course, necessitated a number of changes in names. In the case of the majority of these the author has followed the Code. In three cases he has not done so (*Anthocharis, Colias* and *Gonepteryx*). At least one other case cannot be determined by the Code at present (*Phrissura*) but will require special ruling.

The author is indebted to many persons for assistance and cooperation. To all who have generously aided him he extends his thanks. Especially does he wish to thank Dr. W. T. M. Forbes, Professor J. Chester Bradley, Mr. Frank E. Watson, Dr. William Schaus, Mr. George Talbot of the Hill Museum, and Mr. N. D. Riley of the British Museum.

BIBLIOGRAPHY

Alphéraky ('13). Etudes Lep. Comp. . . . **7**. 1913.

Aurivillius ('95). Ent. Tidskr. **16**. 1895.

('98). Rhopalocera Aethiopica, Stockholm, Norstedt. 1898.

('10). *Pieridae* [in] Seitz, Macrolepidoptera of World, **13**: 29–69. 1910.

Behr ('69). Trans. Am. Ent. Soc. **2**. 1869.

Bingham ('07). Fauna of British India. Butterflies, **2**. 1907.

Boisduval ('32). Collection iconographique et historique des chenilles d'Europe [with Rambur and Graslin] Paris, Roret. 1832–43.

('36). Histoire naturelle des insectes—spécies général des Lépidoptères. Paris, Roret, **1**. 1836.

('47). [in] **Doubleday** and **Westwood,** The genera of Diurnal Lepidoptera. London, Longman. 1846–52. Part **1**. 1846–50.

Boisduval and **Leconte** ('29). Histoire générale et iconographie des Lépidoptères et des Chenilles de l'Amerique septentrionale. Paris, Roret, Pts. **1–8**. 1829–30.

Brown ('29). A revision of the genus Phoebis. American Museum Novitates no. 368. 1929.

Bryk ('29). Ent. Zeit. **42**. 1928.

Butler ('69). Descriptions of new Rhopalocera from the collection of Herbert Druce, Esq. **1**: 1–15. Oct. 1869.

('70). A revision of the genera of the sub-family *Pierinae.* Cistula Entomologica **1**: 33–58, 4 pl. Sept. 12, 1870.

('71). Proc. Zool. Soc. London. 1871.

('71b). Trans. Ent. Soc. London. 1871.

('73). Lepidoptera Exotica. Vol. **1**. 1873.

('87). Ent. Mo. Mag. Vol. **23**. 1887.

Curtis ('24). British Entomology. London, Curtis. 1824–40. Part **1**, pl. 1–50. 1824.

Dalman ('16). Försök till systematisk uppställning af Sveriges fjärilar. Vetensk. Acad. Handl. **37**: 48–101, 199–225, 2 pl. 1816.

('20). in **Billberg,** Enumeratio Insectorum in museo Billberg. Stockholm, Gadel. 1820.

('23). Analecta Entomologica. Holmiae, Lindh. 1823.

Distant ('85). Rhopalocera Malayana. 1885.

Dixey ('94). On the phylogeny of the Pierinae. . . . Trans. Ent. Soc. Lond. part 2, pp. 249–334, 3 pl. 1894.

Donzel ('37). Ann. Soc. Ent. France. **6**. 1837.
Doubleday ('46). The genera of Diurnal Lepidoptera [with **O. Westwood**] London, Longman. **1**. 1846.
Fabricius ('07). Illiger's Magazine. **6**. 1807.
Felder ('62). Verh. Zool-Bot. Ges. Wien, **12**. 1862.
('65). Reise Novara. Lepidoptera. **2**. 1865.
('69). Pet. Nouv. Ent. no. 8. Oct. 1869.
('70). Pet. Nouv. Ent. no. 24. June 1870.
Fruehstorfer ('08). Neues über die Genitalorgane der Pieriden. Ent. Zeitschr. Vol. **22**, no. 47, p. 198–207. 1908.
('10). Family *Pieridae* [in] **Seitz**, Macrolepidoptera of the World. **9**, pt. 1, pp. 119–190. 1910.
('14). Ent. Rundschau, **31**. 1914.
Geyer ('32). **Huebner**, Zutrage Exotische Schmetterlinge, Part 4. 1832.
('37). **Huebner**, Zutrage Exotische Schmetterlinge, Part 5. 1837.
Godman & Salvin ('89). Biologia Centrali-Americana. *Lepidoptera Rhopalocera.* Fam. *Papilionidae*, Subfamily *Pierinae.* **2**: 113–188. 1889.
Gray ('56). List of the specimens of Lepidopterous Insects in the collection of the British Museum. Part 1, *Papilionidae.* 1856.
Grote ('98). Specialization of the Lepidopterous wing, the Pieri-Nymphalidae. Proc. Amer. Philos. Soc. **38**: 17–44, 3 pl. 1898.
('00). The descent of the *Pieridae.* Proc. Amer. Philos. Soc. **39**: 4–67. 1900.
('03). Can. Ent. **35**. 1903.
Herrich-Schaeffer ('67). Prodr. Syst. Lep. **2**. 1867.
('67b). Corr.-Blatt. Regensburg. **21**. 1867.
Horsfield ('29). A descriptive catalogue of the Lepidopterous Insects contained in the Museum of the East India Company. London. Part 1, 1828; Part 2, 1829.
Huebner ('16). Verzeichniss bekannte Schmettlinge. Augsburg. pp. 1–16, 1816; 17–96, 1818; 97–160, 1820?.
('22). Sammlung Exotische Schmetterlinge. Augsburg. 1806–24.
('18). Zutrage Exotische Schmetterlinge. 1818–.
('25). Zutrage zur Sammlung Exotische Schmetterlinge. Augsburg. 1818–1837. Pl. 1–100, 1818; Pl. 101–200, 1823; Pl. 201–300, 1825; etc.

Kaye ('04). Trans. Ent. Soc. Lond. 1904.

Kirby ('71). A synonymic catalogue of diurnal Lepidoptera. London, Van Voorst. 1871.

('77). A synonymic catalogue of diurnal Lepidoptera. Supplement, March 1871–June 1877. London, Van Voorst. 1877.

('96). A handbook to the order Lepidoptera. Vol. 1 [of] Allen's Naturalist's Library. Butterflies, Vol. 2. 1896.

Klots ('28a). A revision of the genus *Eurema*. . . . Part 1, New World species, morphology and phylogeny. Jour. N. Y. Ent. Soc. **36**: 61–76, 4 pl. March 1928.

('28b). A phylogenetic study of the genus *Teriocolias* Roeber. . . . Journ. N. Y. Ent. Soc. **36**: 113–116, 1 pl. June 1928.

('29a). A revision of the genus *Eurema* Hübner. . . . Part 2, New World species, taxonomy and synonomy. Entomologica Americana, **9** (n. ser.) no. 3, pp. 99–171, 4 pl. May 28, 1929.

('29b). The genus *Anteos* Hübner. . . . Bull. Brooklyn Ent. Soc. **24**: 134–142. June 1929.

('29c). The generic status of *Catopsilia* Hübner and *Phoebis* Hübner. . . . Bull. Brooklyn Ent. Soc. **24**: 203–214, 2 pl. Oct. 1929.

('30). A generic revision of the Euchloini. . . . Bull. Brooklyn Ent. Soc. **25**: 80–95. April 1930.

Latreille ('10). Considérations generales sur l'ordre naturel des animaux composant les classes des Crustacés, des Arachnides et des Insectes avec un tableau méthodique de leurs genres disposés en familles. Paris, Schoell. 1810.

Leach ('15). [Article] Entomology [in] Edinburgh Encyclopedia. 1815.

Moore ('78). Ann. & Mag. Nat. Hist. **5**, 1. 1878.

('81). Lepidoptera of Ceylon. **1**. 1881.

('06). Lepidoptera Indica. 1906.

Neustetter ('29). Int. Ent. Zeitung. **23**. 1929.

de Nicéville ('97). Journ. Asiatic. Soc. Bengal. **66**. 1897.

('98). Journ. Bombay Nat. Hist. Soc. **12**. 1898.

Oberthür ('90). Bull. Ann. Soc. Ent. France. 1870.

Pierce ('09). The genitalia of the group Noctuidae of the Lepidoptera of the British Islands. Liverpool, Duncan. 1909.

('14). The genitalia of the group Geometridae of the Lepidoptera of the British Islands. Liverpool, Pierce. 1914.

Ploetz ('70). Stettin. Ent. Zeit. 1870.

Rambur ('36). Notice sur plusiers Lepidoptères du midi de l'Espagne, parmi lesquels se trouve le Papillon eupheme d'Esper. Ann. Soc. Ent. France. **5**. 1836.

Reakirt ('63). Proc. Ent. Soc. Philadelphia. **2**. 1863.

Roeber ('06). [in] Seitz, Macrolepidoptera of the World. Sect. 1, Vol. **1**, Palaearctica. 1906.

('10). [in] Seitz, Macrolepidoptera of the World. Sect. 2, Vol. **5**, Americana. 1910.

Rothschild and **Jordan** ('05). Nov. Zool. 1905.

Schatz ('92). Die familien und gattungen der Tagfalter. . . . Exotische Schmetterlinge. Furth. **2** theil. 1892.

Schaus ('20). Proc. U. S. Nat. Mus. **57**: 107–152. 1920.

Schrank ('01). Fauna Boica **2**, 1. 1801.

Scopoli ('77). Introductio ad historiam naturalem, sistens genera lapidum, plantarum et animalium, etc. Prague, Gerle. 1777.

Scudder ('72). Systematic revision of some of the American Butterflies. Report Peabody Academy Sci. for 1871, Salem, Mass. 1872.

('75). Historical sketch of the generic names proposed for Butterflies. Proc. Am. Ac. Arts & Sci. Vol. **10** (2d ser. Vol. **2**) pp. 89–294. 1875.

Seitz ('27). Macrolep. of World. Vol. **9**. Additions and corrections. 1927.

Smith & Kirby ('93). Rhopalocera Exotica, **24**. Lycaen. Afr. 1893.

Speyer ('39). Lepidopterologische Beitrage. Isis, p. 89–126. 1839.

Staudinger ('94). Iris, **7**. 1894.

Stephens ('28 and '34). Illustrations of British Entomology. Haustellata. **1**. 1828; **4**. 1834.

Swainson ('20). Zoological Illustrations. . . . **1**. 1820–21.

('29). [in] **Horsfield,** Descr. Cat. Lep. East Ind. Mus. 1829.

('32). Zoological Illustrations. . . . 2d ser. 1829–33.

Talbot ('28a). Proc. Ent. Soc. Lond. **3**: 14, 1 pl. 1928.

('28, '29a, '29b, '29c, '30). A monograph of the Pierine genus Delias. London. John Bale Sons, and Danielsson, Ltd. **1**, June 23, 1928; **2**, April 30, 1929; **3**, August 29, 1929; **4**, December 30, 1929; **5**, July 28, 1930.

('32). A new name and diagnosis for a genus of *Pieridae*. Entomologist, **65**: 1–2. February 1932.

Verity ('05). Rhopalocera Palaearctica. Florence, Verity. 1905–11.

('29). Essai sur les origens des Rhopaloceres Europeens et Mediterraneens et particulierement des Anthocharidi et des Lycaenidi du groupe d'Agestis Schiff. Ann. Soc. Ent. France, **98**. 1929.

Wallace ('67). Trans. Ent. Soc. London, ser. 3, **4**. 1867.

Wallengren ('53). Lepidoptera Rhopalocera Scandinaviae disposita ac descripta. Scandinaviens dagfjärilar. Malmo, Cronholm. 1853.

('57). Kafferlandets Dagfjärilarinsamlade ären 1838–1845. Vetensk. Acad. Handl. **2, 1**: 1–55. 1857.

('58). Nya Fjäril-Slägten. Oefvers. K. Vet. Akad. Förh. **15**: 75–84. 1858.

Westwood ('34). Description of the nest of a gregarious species of butterfly from Mexico. Trans. Ent. Soc. Lond. **1**: 38–44. 1834.

('40). An introduction to the modern classification of insects. . . . Part **2**. 1840.

Zander ('03). Beitrage zur Morphologie der männlichen Geschlechts anhänge der Lepidopteren. Zeitschr. wiss. Zool. **72**. 1903.

INDEX TO GENERIC NAMES

The number given after each name refers to the number of the genus in which the name will be found, both in the checklist of genera and the discussions.

EXPLANATION OF FIGURES

(Plates V–XIII)

All figures of the male genitalia are of the left lateral aspect, unless specifically stated to be otherwise. In the *Pierinae* the genitalia have been drawn with the right harpé removed. In the *Dismorphiinae* and *Pseudopontiinae* this has not been done.

The figures of the genitalia are intended to represent these organs in their natural shape, without distortion or flattening. In most cases the harpé has been shown as normally articulated to the vinculum and tegumen. In a few cases it has been drawn detached from these structures. Spines on the harpé have been drawn as if flattened in the plane of the harpé, in order to show their size and shape, although their normal position may be at an angle with the plane of the harpé.

In most cases the penis has been drawn below the other structures. In a few *Dismorphiinae* it is shown *in situ*.

No attempt has been made to show the membranous areas, excepting where a chitinization in the subcaphium has necessitated showing part of the median fold. The point where the anal membranes attach to the ventral part of the uncus has been shown by a short line.

The juxta has been shown attached to the sacculus except where its relation to the median fold or vinculum has seemed important.

Inasmuch as mere size is not regarded as a genitalic character the structures have all been drawn approximately the same size, with no fixed scale of enlargement.

Plate V

Figure

1. Diagrammatic representation of generalized Pierid male genitalia. The basal portion of the penis and its surrounding structures have been shown in optical section. The membrane extending from the basal edge of the outer layer of the harpé to the vinculum has not been shown.
2. Venation of *Pseudopieris nehemia* Boisd.
3. " " *Nepheronia argia* Fabr.
4. " " *Leucidia brephos* Hueb.
5. " " *Pieris brassicae* L.
6. " " fore wing, *Phoebis argante* Hueb.
7. " " *Leptosia alcesta* Cr.
8. Various structures of *Pieris brassicae* L.
   a. Lateral aspect of fore leg
   b. Lateral aspect of end of tarsus

c. Dorsal aspect of end of tarsus
d. Lateral aspect of palpus
9. Lateral aspect of palpus, *Anteos maerula* Fabr.
10. Lateral aspect of pupa, *Pereute nigricans* J. & T.
11. Left lateral aspect, ♂ genitalia, *Pseudopontia paradoxa* Feld.

Plate VI

Figure
12. Left lateral aspect, ♂ genitalia, *Leptidia sinapis* L.
13. " " " " " *Pseudopieris nehemia* Boisd.
14. " " " " " *Dismorphia astynome* Dalm.
15. " " " " " *Acmepteron nemesis* Latr.
16. " " " " " *Enantia licinia* Hueb.
17. " " " " " *Moschoneura pinthaeus* L.
18. " " " " " *Patia orise* Boisd.
19. " " " " " *Eroessa chilensis* Blanch.
20. " " " " " *Anthocharis cardamines* L.
21. " " " " " *Zegris eupheme* Esp.
a. Enlarged drawing of dorsal spine of harpé
22. Left lateral aspect, ♂ genitalia, *Euchloë belia* Cr.
23. " " " " " *Hesperocharis erota* Luc.

Plate VII

Figure
24. Left lateral aspect, ♂ genitalia, *Cunizza hirlanda apicalis* Fruehst.
25. " " " " " *Mathania agasicles* Hew.
26. " " " " " *Pinacopteryx eriphia* Godt.
27. " " " " " *Hebomoia glaucippe* L.
a. Dorsal aspect of tip of uncus
28. Left lateral aspect, ♂ genitalia, *Colias hyale* L.
a. Lateral aspect of tip of penis, enlarged
29. Left lateral aspect, ♂ genitalia, *Zerene caesonia* Stoll.
30. " " " " " *Catopsilia crocale* L.
31. " " " " " *Anteos* (*Rhodocera*) *menippe* Hueb.
32. " " " " " *Gonepteryx rhamni* L.
33. " " " " " *Dercas gobrias* Hew.
34. " " " " " *Phoebis argante* Fabr.
35. " " " " " *Rhabdodryas trite* L.

Plate VIII

Figure
36. Left lateral aspect, ♂ genitalia, *Aphrissa statira* Cr.
a. Lateral aspect, tip of penis, greatly enlarged
b. Lateral aspect of juxta